OFFSITE DOSE CALCULATION MANUAL

NUCLEAR ORGANIZATION

UNITS 2 AND 3

SO23-ODCM
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ODCM

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INTRODUCTION

The OFFSITE DOSE CALCULATION MANUAL (ODCM) is a supporting document of the RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS (NUREG 0472). The ODCM enumerates dose and concentration specifications, instrument requirements, as well as describes the methodology and parameters to be used in the calculation of offsite doses from radioactive liquid and airborne effluents. In order to meet release limits, it additionally provides calculations for liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints. The environmental section contains a list of the sample locations for the radiological environmental monitoring program.

The ODCM will be maintained at the Site for use as a document of Specifications and acceptable methodologies and calculations to be used in implementing the Specifications. Changes in the calculational methods or parameters will be incorporated into the ODCM in order to assure that the ODCM represents current methodology.

1.0 LIQUID EFFLUENTS

1.1 CONCENTRATION

SPECIFICATION

1.1.1 The concentration of radioactive material released from the site (see Figure 1-2) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2 x 10^{-4} microcuries/ml total activity.

APPLICABILITY: At all times

ACTION:

a. With the concentration of radioactive material released from the site exceeding the above limits, immediately restore the concentration to within the above limits.

SURVEILLANCE REQUIREMENTS

.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 1-1.

.2 The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in Section 1.4 to assure that the concentrations at the point of release are maintained within the limits of Specification 1.1.1.

TABLE 1-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/ml)[a]
A. Batch Waste Release[d]	P Each Batch	P Each Batch	Principal Gamma Emitters[f]	$5x10^{-7}$
			I-131	$1x10^{-6}$
	P One Batch/M	M	Dissolved and Entrained Gases (Gamma emitters)	$1x10^{-5}$
	P Each Batch	M Composite[b]	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	P Each Batch	Q Composite[b]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

NOTE BATCH RELEASE POINTS: Primary Plant Makeup Storage Tanks, Radwaste Primary Tanks, Radwaste Secondary Tanks, Miscellaneous Waste Condensate Monitor Tanks, Blowdown Processing System Neutralization Sump, FFCPD sumps (high conductivity, low conductivity) and holdup tank, Component Cooling Water Sump, Storage Tank Area Sump, S/G Blowdown.

B. Continuous Releases[e],	D Grab Sample	W Composite[c]	Principal Gamma Emitters[f]	$5x10^{-7}$
			I-131	$1x10^{-6}$
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma emitters)	$1x10^{-5}$
	D Grab Sample	M Composite[c]	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	D Grab Sample	Q Composite[c]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

NOTE CONTINUOUS RELEASE POINTS: Turbine Plant Sump*, Blowdown Processing System Neutralization Sump**, S/G Blowdown Bypass Line***, S/G Blowdown, Auxiliary Building Sump.*

TABLE 1-1 (Continued)

TABLE NOTATION

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

LLD is the "a priori" lower limit of detection as defined above (as microcurie per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per transformation),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental samples).

The value of s_b used in the calculation of the LLD for a particular measurement system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance.

Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of the measurement system and not as a posteriori (after the fact) limit for a particular measurement.[1]

[1]For a more complete discussion of the LLD, and other detection limits, see the following:
(1) HASL Procedures Manual, HASL-300 (revised annually).
(2) Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968).
(3) Hartwell, J. K., "Detection Limits for Radioisotopic Counting Techniques," Atlantic Richfield Hanford Company Report ARH-2537 (June 22, 1972).

TABLE 1-1 (Continued)

TABLE NOTATION

b. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

c. To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

d. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed, by a method described in the ODCM, to assure representative sampling.

e. A continuous release is the discharge of liquid wastes of a nondiscrete volume; e.g., from a volume of system that has an input flow during the continuous release.

f. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

* Administrative controls shall ensure that only one continuous release point is discharging through a discharge path at any given time. The normal continuous release point via 2(3)RT-7821 is the turbine plant sump.

** The first sump when transferring outlying sumps shall be treated as a batch release.

*** Sampling of this flow is not required if at least once per 31 days blowdown bypass isolation valve (S21301MU619 for Steam Generator 2E088, S21301MU618 for Steam Generator 2E089, S31301MU619 for Steam Generator 3E088 and S31301MU618 for Steam Generator 3E089) is verified locked shut.

1.0 **LIQUID EFFLUENTS** (Continued)

1.2 DOSE

SPECIFICATION

1.2.1 The dose or dose commitment to an individual from radioactive materials in liquid effluents released, from each reactor unit, from the site (see Figure 1-2) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ, and

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times

ACTION:

a. With calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission within 30 days, pursuant to Technical Specification Section 5.7.2 and LCS 5.0.104.2, a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions taken to reduce the releases and the proposed actions to be taken to assure that subsequent releases will be in compliance with Specification 1.2.1.

SURVEILLANCE REQUIREMENTS

.1 Dose Calculation. Cumulative dose contributions from liquid effluents shall be determined in accordance with Section 1.5 at least once per 31 days.

1.0 **LIQUID EFFLUENTS** (Continued)

1.3 LIQUID WASTE TREATMENT

SPECIFICATION

1.3.1 The liquid radwaste treatment system shall be OPERABLE. The appropriate portions of the system shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses due to the liquid effluent from the site (see Figure 1-2) when averaged over 31 days, would exceed 0.06 mrem to the total body or 0.2 mrem to any organ.*

APPLICABILITY: At all times

ACTION:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission within 30 days pursuant to Technical Specification Section 5.7.2 and LCS 5.0.104.2, a Special Report which includes the following information:

   1. Explanation of why liquid radwaste was being discharged without treatment, identification of the inoperable equipment or subsystems and the reason for inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

SURVEILLANCE REQUIREMENTS

.1 Doses due to liquid releases shall be projected at least once per 31 days, in accordance with Section 3.1.

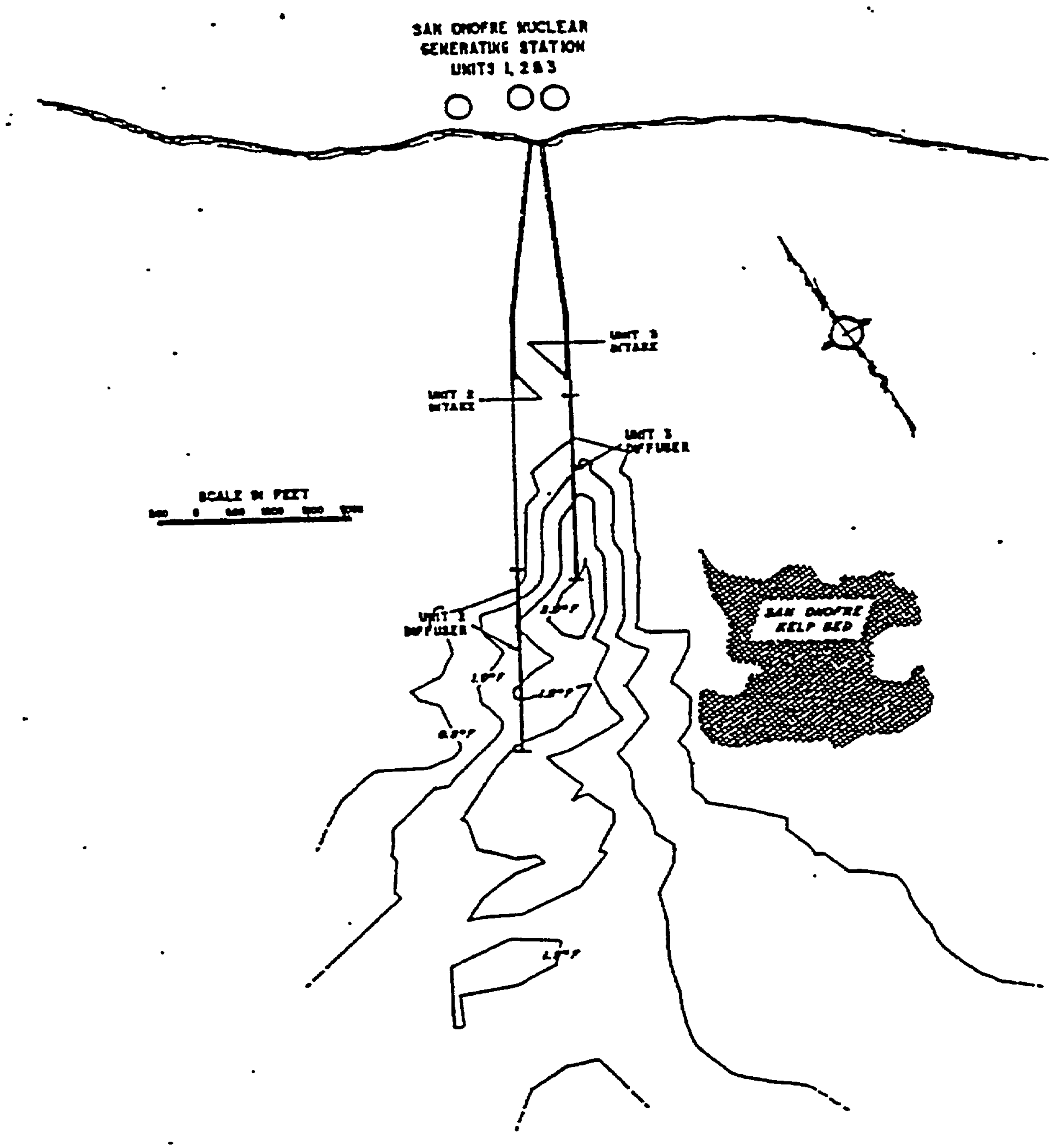
.2 During plant operation (either unit in Mode 1-4), the appropriate portions of the liquid radwaste treatment system shall be demonstrated OPERABLE by operating the liquid radwaste treatment system equipment for at least 15-minutes at least once per 92 days unless the liquid radwaste system has been utilized to process radioactive liquid effluents during the previous 92 days.

.3 In plant shut-down (both units in Mode 5,6), the appropriate portions of the liquid radwaste treatment system shall be demonstrated OPERABLE by operating the liquid radwaste treatment system equipment for at least 15-minutes prior to processing liquids unless the appropriate liquid radwaste system has been utilized to process radioactive liquid effluents during the previous 92 days.

*Per reactor unit

SITE BOUNDARY FOR LIQUID EFFLUENTS

FIGURE 1-2



1.0 **LIQUID EFFLUENTS** (Continued)

1.4 LIQUID EFFLUENT MONITOR METHODS OF SETPOINT CALCULATION

Liquid Radwaste Effluent Line Monitors provide alarm and automatic termination of release prior to exceeding the concentration limits specified in 10CFR20, Appendix B, Table II, Column 2 at the release point to the unrestricted area. To meet this specification and for the purpose of implementation of Specification 1.1.1, the alarm/trip setpoints for liquid effluent monitors and flow measurement devices are set to assure that the following equation is satisfied:

$$\left(\frac{C_m R}{F+R}\right) \leq MPC_{eff} \qquad \textbf{(1-1)}$$

where:

C_m = setpoint, representative of a radionuclide concentration for the radiation monitor measuring the radioactivity in the waste effluent line prior to dilution and subsequent release, μCi/ml

R = permissible waste effluent flow rate at the radiation monitor location, in volume per unit time in the same units as for F

F = dilution water flow in volume per unit time.
= 185,000 gpm per circulating water pump (4 total)*
= 17,000 gpm per saltwater pump (2 total)

* The design flowrate of each circulating water pump is 205,000 gpm. The value used in the determination of F takes into account factors such as frictional losses, pump inefficiency, and tidal flow, and provides reasonable assurance that the radioactive release concentration is not underestimated.

NOTE: Since the values of R are much smaller than F, the term (F + R) in equation (1-1) may be replaced by F.

1.4 LIQUID EFFLUENT MONITOR METHODS OF SETPOINT CALCULATION (Continued)

MPC_{eff} = effective effluent maximum concentration permissible limit (μCi/ml) at the release point to the unrestricted area for the radionuclide mixture being released:

$$= \left(\frac{1}{\sum_{i=1}^{n} \left(\frac{F_i}{MPC_i} \right)} \right) \qquad (1\text{-}2)$$

where:

n = number of radionuclides identified in sample analysis

F_i = fractional concentration of the i^{th} radionuclide as obtained by sample analysis

MPC_i = MPC of the i^{th} radionuclide (10CFR20, App B, Table II, Column 2)

Administrative values are used to reduce each setpoint to account for the potential activity released simultaneously from the following release points:

RW_{7813} = Radwaste Effluent discharge
SG_{88-2} = Unit 2 Steam Generator E-088
SG_{89-2} = Unit 2 Steam Generator E-089
SG_{88-3} = Unit 3 Steam Generator E-088
SG_{89-3} = Unit 3 Steam Generator E-089
B_2 = Unit 2 Blowdown Processing System Neutralization Sump
B_3 = Unit 3 Blowdown Processing System Neutralization Sump
T_2 = Unit 2 Turbine Plant Sump
T_3 = Unit 3 Turbine Plant Sump

The sum of the administrative values is limited to 1.0 to ensure that the total concentration from all release points to the plant discharge will not result in a release exceeding the limits of 10CFR20, Appendix B, Table II, Column 2 from Units 2 and 3. The administrative values shall be assigned such that:

$$(RW_{7813} + SG_{88-2} + SG_{89-2} + SG_{88-3} + SG_{89-3} + B_2 + B_3 + T_2 + T_3) \leq 1.0.$$

The administrative values shall be periodically reviewed based on actual release data and revised as necessary.

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.1 BATCH RELEASE SETPOINT DETERMINATION

The waste flow (R) and monitor setpoint (C_m) are set to meet the condition of equation (1-1) for the MPC_{eff} limit. The method by which this is accomplished is as follows:

STEP 1: The isotopic concentration for each batch tank (or sump) to be released is obtained from the sum of the measured concentrations in the tank (or sump) as determined by analysis.

$$C = \left(\Sigma_i C'_{\gamma_i}\right) + \left(C_\alpha\right) + \left(C_s\right) + \left(C_t\right) + \left(C_{Fe}\right) + \left(C_{Xe}\right) \quad \textbf{(1-3)}$$

where:

C = total concentration in each batch tank, μCi/ml

$\Sigma_i C'_{\gamma i}$ = sum of the measured concentrations for each radionuclide, i, in the gamma spectrum, excluding Xe-133, μCi/ml

C_α = gross alpha concentration determined in the previous monthly composite sample, μCi/ml

C_s = Sr-89 and Sr-90 concentrations as determined in the previous quarterly composite sample, μCi/ml

C_t = H-3 concentration as determined in the previous monthly composite sample, or as measured in the sample taken prior to release, μCi/ml

C_{Fe} = Fe-55 concentration as determined in the previous quarterly composite sample, μCi/ml

C_{Xe} = Xe-133 concentration as determined by isotopic analysis, μCi/ml

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.1 BATCH RELEASE SETPOINT DETERMINATION (Continued)

STEP 2: The effective MPC (MPC_{eff}) for each batch tank (or sump) is determined using:

$$MPC_{eff} = \frac{1}{\sum_i \left(\frac{C_{\gamma i}/C}{MPC_{\gamma i}}\right) + \left(\frac{C_s/C}{MPC_s}\right) + \left(\frac{C_t/C}{MPC_t}\right) + \left(\frac{C_\alpha/C}{MPC_\alpha}\right) + \left(\frac{C_{Fe}/C}{MPC_{Fe}}\right)} \quad \textbf{(1-4)}$$

where:

$MPC_{\gamma i}$, MPC_s, MPC_t, MPC_{Fe}, MPC_α = the limiting concentrations of the appropriate radionuclide from 10CFR20, Appendix B, Table II, Column 2

NOTE: For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-4 μCi/ml total activity.

STEP 3: The setpoint, C_m (μCi/ml) for each batch release radioactivity monitor may now be specified based on the respective values of C, $\Sigma_i C'_{\gamma i}$, F, MPC_{eff}, and R to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2.

STEP 4: If the monitor reads in CPM, the setpoint may be derived using the applicable calibration constants given in Table 1-3 to correspond to the calculated monitor limit C_m, μCi/ml.

$$CPM_{max} = \frac{(C_m,\ \mu Ci/ml)}{(Cal.\ Const.,\ \mu Ci/cc/cpm)} \quad \textbf{(1-5)}$$

1.4.1 BATCH RELEASE SETPOINT DETERMINATION (Continued)

1.4.1.1 RADWASTE DISCHARGE LINE MONITOR (2/3RT-7813)

The value for C_m, the concentration limit at the detector, is determined by using:

$$C_m \leq \frac{(RW_{7813})\,(F)\,(\Sigma_i C'_{\gamma i})}{(R)\left(\frac{C}{MPC_{eff}}\right)} \qquad \textbf{(1-6)}$$

where:

RW_{7813} = Radwaste Effluent discharge administrative value

F = dilution water flow in volume per unit time
= 185,000 gpm per circulating water pump (4 total)
= 17,000 gpm per saltwater pump (2 total)

C = Total concentration in each batch sample

$\Sigma_i C'_{\gamma i}$ = total gamma isotopic concentration, excluding Xe-133, μCi/ml

R = typical effluent release rate.
Values of R for each tank are as follows:
Radwaste Primary Tanks = 140 gpm (per pump)
Radwaste Secondary Tanks = 140 gpm (per pump)
Primary Plant Makeup Tank = 160 gpm (per pump)
Condensate Monitor Tanks = 100 gpm (per pump)

MPC_{eff} = from equation (1-4)

NOTE: If $C_m \leq \Sigma_i C'_{\gamma i}$, then no release is possible. To increase C_m, increase the administrative value RW_{7813}, and/or increase dilution flow F (by running more dilution pumps in the applicable discharge structure), and/or decrease the effluent flow rate R and recalculate C_m using the new RW_{7813}, F, R as applicable and equation (1-6).

1.4.1.2 BLOWDOWN PROCESSING SYSTEM NEUTRALIZATION SUMP/FULL FLOW CONDENSATE POLISHER DEMINERALIZER (FFCPD) SUMP DISCHARGE LINE MONITOR (BATCH) (2RT-7817, 3RT-7817)

The value for C_2 (Unit 2) or C_3 (Unit 3), the concentration limit at the Unit 2 or Unit 3 detector, is determined by using:

$$C_2 \leq \frac{(B_2)(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \qquad \textbf{(1-7)}$$

$$C_3 \leq \frac{(B_3)(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \qquad \textbf{(1-8)}$$

where:

C_2 = instantaneous concentration at detector 2RT-7817 in μCi/cc

C_3 = instantaneous concentration at detector 3RT-7817 in μCi/cc

B_2 = Unit 2 BPS Neutralization Sump administrative value

B_3 = Unit 3 BPS Neutralization Sump administrative value

F = dilution water flow in volume per unit time
= 185,000 gpm per circulating water pump (4 total)
= 17,000 gpm per saltwater pump (2 total)

$\Sigma_i C'_{\gamma i}$ = total gamma isotopic concentration, excluding Xe-133, μCi/ml, (STEP 1)

R = Typical release flow rates:

BPS Neutralization Sump	=	500 gpm
FFCPD High Conductivity Sump	=	500 gpm
FFCPD Low Conductivity Sump	=	600 gpm
FFCPD Holdup Tank	=	1000 gpm

C = total concentration in each batch sample, μCi/ml

MPC_{eff} = value of MPC_{eff} from equation (1-4) for the sample analysis

NOTE: If C_2 or $C_3 \leq \Sigma_i C'_{\gamma i}$, then no release is possible. To increase C_2 or C_3, increase the administrative value B_2 or B_3, and/or increase dilution flow F (by running more dilution pumps), and/or decrease the effluent flow rate, R, and recalculate C_2 or C_3 using the new B_2 or B_3, F, R as applicable and equation (1-7) or (1-8).

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.2 CONTINUOUS RELEASE SETPOINT DETERMINATION

The waste flow (R) and monitor setpoint (C_m) are set to meet the condition of equation (1-1) for the effective MPC (MPC_{eff}) limit. The method by which this is accomplished is as follows:

STEP 1: The isotopic concentration for the continuous releases are obtained for each release stream (steam generator blowdown, steam generator blowdown bypass, blowdown processing system neutralization sump and turbine plant sump) from the sum of the respective measured concentrations as determined by analysis:

$$C = \left(\Sigma_i C'_{\gamma_i}\right) + \left(C_\alpha\right) + \left(C_s\right) + \left(C_t\right) + \left(C_{Fe}\right) + \left(C_{Xe}\right) \quad \textbf{(1-3)}$$

where:

C = total concentration (μCi/ml)

$\Sigma_i C'_{\gamma i}$ = total gamma activity associated with each radionuclide, i, in the weekly composite analysis for the release stream, excluding Xe-133, μCi/ml

C_α = total measured gross alpha concentration determined from the previous monthly composite analysis for the release stream, μCi/ml

C_s = total measured concentration of Sr-89 and Sr-90 as determined from the previous quarterly composite analysis for the release stream, μCi/ml

C_t = total measured H-3 concentration determined from the previous weekly or monthly composite analysis for the release stream, μCi/ml

C_{Fe} = total Fe-55 concentration as determined in the previous quarterly composite sample for the release stream, μCi/ml

C_{Xe} = Xe-133 concentration as determined by isotopic analysis, μCi/ml

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.2 CONTINUOUS RELEASE SETPOINT DETERMINATION (Continued)

STEP 2: The effective MPC (MPC_{eff}) for each release stream (steam generator blowdown, blowdown processing system neutralization sump, or turbine plant sump) is determined using:

$$MPC_{eff} = \frac{1}{\sum_i \left(\frac{C_{\gamma i}/C}{MPC_{\gamma i}}\right) + \left(\frac{C_s/C}{MPC_s}\right) + \left(\frac{C_t/C}{MPC_t}\right) + \left(\frac{C_\alpha/C}{MPC_\alpha}\right) + \left(\frac{C_{Fe}/C}{MPC_{Fe}}\right)} \qquad \textbf{(1-4)}$$

where:

$MPC_{\gamma i}$, MPC_s, MPC_t, MPC_{Fe}, MPC_α = the limiting concentrations of the appropriate radionuclide from 10CFR20, Appendix B, Table II, Column 2

STEP 3: The setpoint, C_m (μCi/ml) for each continuous release radioactivity monitor may now be specified based on the respective values of C, $\Sigma_i C'_{\gamma i}$, F, MPC_{eff}, and R to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2.

STEP 4: If the monitor reads in CPM, the setpoint may be derived using the applicable calibration constants given in Table 1-3 to correspond to the calculated monitor limit C_m, μCi/ml.

$$CPM_{max} = \frac{(C_m,\ \mu Ci/ml)}{(Cal.\ Const.,\ \mu Ci/cc/cpm)} \qquad \textbf{(1-5)}$$

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.2.1 BLOWDOWN PROCESSING SYSTEM NEUTRALIZATION SUMP DISCHARGE LINE MONITORS (2RT-7817, 3RT-7817)

The value for C_2 (Unit 2) or C_3 (Unit 3), the concentration limit at the Unit 2 or Unit 3 detector, is determined by using:

$$C_2 \le \frac{(B_2)(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \qquad (1\text{-}7)$$

$$C_3 \le \frac{(B_3)(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \qquad (1\text{-}8)$$

where:

C_2 = instantaneous concentration at detector 2RT-7817 in μCi/cc

C_3 = instantaneous concentration at detector 3RT-7817 in μCi/cc

B_2 = Unit 2 Blowdown Processing System Neutralization Sump administrative value

B_3 = Unit 3 Blowdown Processing System Neutralization Sump administrative value

F = dilution water flow in volume per unit time
= 185,000 gpm per circulating water pump (4 total)
= 17,000 gpm per saltwater pump (2 total)

$\Sigma_i C'_{\gamma i}$ = total gamma isotopic concentration, excluding Xe-133, μCi/ml, (STEP 1)

R = effluent flow rate, gpm, (STEP 1), (maximum of 500 gpm)

C = total concentration, μCi/ml

MPC_{eff} = value of MPC_{eff} from equation (1-4) for the sample analysis

NOTE: If C_2 or $C_3 \le \Sigma_i C'_{\gamma i}$, then no release is possible. To increase C_2 or C_3, increase the administrative value B_2 or B_3, and/or increase dilution flow F (by running more dilution pumps), and/or decrease the effluent flow rate, R, and recalculate C_2 or C_3 using the new B_2 or B_3, F, R as applicable and equation (1-7) or (1-8).

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.2.2 STEAM GENERATOR BLOWDOWN BYPASS DISCHARGE LINE MONITORS (2RT-6753, 2RT-6759, 3RT-6753, 3RT-6759)

The value for C_{59-2}, C_{53-2}, C_{59-3} or C_{53-3}, the concentration limit at the Unit 2 or Unit 3 detectors, is determined by using:

$$C_{59-2} \leq \frac{(SG_{88-2})(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \quad (1-9)$$

$$C_{53-2} \leq \frac{(SG_{89-2})(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \quad (1-10)$$

$$C_{59-3} \leq \frac{(SG_{88-3})(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \quad (1-11)$$

$$C_{53-3} \leq \frac{(SG_{89-3})(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \quad (1-12)$$

where:

C_{59-2} = instantaneous concentration at detector 2RT-6759 in μCi/ml

C_{53-2} = instantaneous concentration at detector 2RT-6753 in μCi/ml

C_{59-3} = instantaneous concentration at detector 3RT-6759 in μCi/ml

C_{53-3} = instantaneous concentration at detector 3RT-6753 in μCi/ml

SG_{88-2} = Unit 2 E088 Steam Generator Blowdown administrative value

SG_{89-2} = Unit 2 E089 Steam Generator Blowdown administrative value

SG_{88-3} = Unit 3 E088 Steam Generator Blowdown administrative value

SG_{89-3} = Unit 3 E089 Steam Generator Blowdown administrative value

F = dilution water flow in volume per unit time
= 185,000 gpm per circulating water pump (4 total)
= 17,000 gpm per saltwater pump (2 total)

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.2.2 STEAM GENERATOR BLOWDOWN BYPASS DISCHARGE LINE MONITORS (2RT-6753, 2RT-6759, 3RT-6753, 3RT-6759) (Continued)

$\Sigma_i C'_{\gamma i}$ = total gamma isotopic concentration, excluding Xe-133, μCi/ml, (STEP 1)

R = maximum blowdown bypass effluent flowrate per steam generator, 200 gpm, (STEP 1)

C = total concentration, μCi/ml

MPC_{eff} = value of MPC_{eff} from equation (1-4) for the sample analysis

NOTE: If C_{59-2}, C_{53-2}, C_{59-3}, or $C_{53-3} \leq \Sigma_i C'_{\gamma i}$ (for the respective steam generator), then no release is possible. To increase C_{59-2}, C_{53-2}, C_{59-3} or C_{53-3}, increase the administrative value SG_{88-2}, SG_{89-2}, SG_{88-3} or SG_{89-3}, and/or increase dilution flow F (by running more dilution pumps), and/or decrease the effluent flow rate R and recalculate C_{59-2}, C_{53-2}, C_{59-3} or C_{53-3} using the new values of SG_{89-2}, SG_{88-2}, SG_{89-3} or SG_{88-3}, F, R as applicable and equation (1-9), (1-10), (1-11) or (1-12).

1.0 LIQUID EFFLUENTS (Continued)

1.4.2.3 TURBINE PLANT SUMP MONITORS (2RT-7821, 3RT-7821)

The value for C_2 (Unit 2) or C_3 (Unit 3), the concentration limit at the Unit 2 or Unit 3 detector, is determined by using:

$$C_2 \le \frac{(T_2)(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \qquad \textbf{(1-13)}$$

$$C_3 \le \frac{(T_3)(F)(\Sigma_i C'_{\gamma i})}{(R)(C/MPC_{eff})} \qquad \textbf{(1-14)}$$

where:

C_2 = instantaneous concentration at detector 2RT-7821 in μCi/cc

C_3 = instantaneous concentration at detector 3RT-7821 in μCi/cc

T_2 = Unit 2 Turbine Plant Sump administrative value

T_3 = Unit 3 Turbine Plant Sump administrative value

F = dilution water flow in volume per unit time
= 185,000 gpm per circulating water pump (4 total)
= 17,000 gpm per saltwater pump (2 total)

$\Sigma_i C'_{\gamma i}$ = total gamma isotopic concentration, excluding Xe-133, μCi/ml, (STEP 1)

R = effluent flow rate, gpm, (STEP 1), typically flow rate:
= 100 gpm (per pump)

C = total concentration, μCi/ml

MPC_{eff} = value of MPC_{eff} from equation (1-4) for the sample analysis

NOTE: If C_2 or $C_3 \le \Sigma_i C'_{\gamma i}$, then no release is possible. To increase C_2 or C_3, increase the administrative value T_2 or T_3, and/or increase dilution flow F (by running more dilution pumps), and/or decrease the effluent flow rate, R, and recalculate C_2 or C_3 using the new T_2 or T_3, F, R as applicable and equation (1-13) or (1-14).

1.0 **LIQUID EFFLUENTS** (Continued)

1.4.2.3 TURBINE PLANT SUMP MONITORS (2RT-7821, 3RT-7821) (Continued)

Use of a temporary discharge path from the Turbine Plant Sump is allowed providing the radiation monitor, 2(3)RT-7821, is in service and the normal discharge path is used concurrently. Temporary pumps facilitate faster discharge when draining the condenser to the outfall via this pathway. The following conditions shall be met:

a. The release permit shall account for the entire volume of water discharged from the Turbine Plant Sump.

b. The alarm setpoint for the monitor shall be adjusted to take into account the entire discharge flow through both the normal and temporary paths.

c. Procedures shall require the immediate termination of the discharge via the temporary path if the monitor on the normal path alarms.

TABLE 1-3

Liquid Effluent Radiation Monitor Calibration Constants [a]
(μCi/cc/cpm)

MONITOR	Co-60	Ba-133	Cs-137
2RT-6753		2.07E-8	1.90E-8
2RT-6759		1.90E-8	1.90E-8
3RT-6753		1.92E-8	1.92E-8
3RT-6759		1.98E-8	1.97E-8

[a] This table provides typical (± 20%) calibration constants for the liquid effluent radiation monitors.

1.0 **LIQUID EFFLUENTS** (Continued)

1.5 DOSE CALCULATION FOR LIQUID EFFLUENTS

The liquid releases considered in the following dose calculations are described in Section 1.4. The dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas are calculated for the purpose of implementing Specification 1.2.1 using the following expression.

$$D_\tau = \Sigma_i\left[A_{i\tau}\ \Sigma_j\left(\Delta t_j\ C_{ij}\ F_j\right)\right] \qquad \textbf{(1-15)}$$

where:

$A_{i\tau}$ = Site-related adult ingestion dose commitment factor to the total body or an organ, τ, for each identified principal gamma and beta emitter, i, from Table 1-4 in mrem/hr per μCi/ml.

C_{ij} = average concentration of radionuclide, i, in the undiluted liquid effluent during time period, Δt_j, in μCi/ml.

D_τ = dose commitment to the total body or an organ, τ, from the liquid effluent for the time period, Δt_j, in mrem.

F_j = near field average dilution factor (actually mixing ratio) for C_{ij} during the time period, Δt_j. This factor is the ratio of the maximum undiluted liquid waste flow during time period, Δt_j, to the average flow from the site discharge structure to unrestricted receiving waters,

or: $$\left(\frac{\text{maximum liquid radioactive waste flow}}{\text{discharge structure exit flow}}\right)$$

Δt_j = length of the j^{th} time period over which C_{ij} and F_j are averaged for all liquid releases, in hours.

TABLE 1-4

DOSE COMMITMENT FACTORS*, $A_{i\tau}$
(mrem/hr per μCi/ml)

Radio-nuclide	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
H-3		2.82E-1	2.82E-1	2.82E-1	2.82E-1	2.82E-1	2.82E-1
Na-24	4.57E-1	4.57E-1	4.57E-1	4.57E-1	4.57E-1	4.57E-1	4.57E-1
Cr-51			5.58E+0	3.34E+0	1.23E+0	7.40E+0	1.40E+3
Mn-54		7.06E+3	1.35E+3		2.10E+3		2.16E+4
Mn-56		1.78E+2	3.15E+1		2.26E+2		5.67E+3
Fe-55	5.11E+4	3.53E+4	8.23E+3			1.97E+4	2.03E+4
Fe-59	8.06E+4	1.90E+5	7.27E+4			5.30E+4	6.32E+5
Co-57		1.42E+2	2.36E+2				3.59E+3
Co-58		6.03E+2	1.35E+3				1.22E+4
Co-60		1.73E+3	3.82E+3				3.25E+4
Cu-64		2.14E+2	1.01E+2		5.40E+2		1.83E+4
Zn-65	1.61E+5	5.13E+5	2.32E+5		3.43E+5		3.23E+5
Br-84			9.39E-2				7.37E-7
Rb-88		1.79E+0	9.49E-1				2.47E-11
Sr-89	4.99E+3		1.43E+2				8.00E+2
Sr-90	1.23E+5		3.01E+4				3.55E+3
Sr-91	9.18E+1		3.71E+0				4.37E+2
Sr-92	3.48E+1		1.51E+0				6.90E+2
Y-90	6.06E+0		1.63E-1				6.42E+4
Y-91m	5.73E-2		2.22E-3				1.68E-1
Y-92	5.32E-1		1.56E-2				9.32E+3
Zr-95	1.59E+1	5.11E+0	3.46E+0		8.02E+0		1.62E+4
Zr-97	8.81E-1	1.78E-1	8.13E-2		2.68E-1		5.51E+4
Nb-95	1.84E+0	1.03E+0	5.51E-1		1.01E+0		6.22E+3
Nb-95m	1.84E+0	1.03E+0	5.51E-1		1.01E+0		6.22E+3
Nb-97	1.55E-2	3.91E-3	1.43E-3		4.56E-3		1.44E+1
Mo-99		1.28E+2	2.43E+1		2.89E+2		2.96E+2
Tc-99m	1.30E-2	3.66E-2	4.66E-1		5.56E-1	1.79E-2	2.17E+1

NOTE: where no value is given, no data are available.

* Source: Reg. Guide 1.109, Table E-11, Table A-1
USNRC NUREG-0172, Table 4
ICRP-30, Part 3, Supplement A

Methodology: USNRC NUREG-0133, Section 4.3.1

TABLE 1-4
(Continued)

DOSE COMMITMENT FACTORS*, $A_{i\tau}$
(mrem/hr per μCi/ml)

Radio-nuclide	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Ru-103	1.07E+2		4.60E+1		4.07E+2		1.25E+4
Ru-106	1.59E+3		2.01E+2		3.06E+3		1.03E+5
Ag-110m	1.42E+3	1.32E+3	7.82E+2		2.59E+3		5.37E+5
Sn-113							2.26E+5
Sn-117m							2.26E+5
Sb-124	2.76E+2	5.22E+0	1.09E+2	6.70E-1		2.15E+2	7.84E+3
Sb-125	1.77E+2	1.97E+0	4.20E+1	1.79E-1		1.36E+2	1.94E+3
Te-129m	9.31E+2	3.47E+2	1.47E+2	3.20E+2	3.89E+3		4.69E+3
Te-132	2.04E+2	1.32E+2	1.24E+2	1.46E+2	1.27E+3		6.24E+3
I-131	2.18E+2	3.12E+2	1.79E+2	1.02E+5	5.35E+2		8.23E+1
I-132	1.06E+1	2.85E+1	9.96E+0	9.96E+2	4.54E+1		5.35E+0
I-133	7.45E+1	1.30E+2	3.95E+1	1.90E+4	2.26E+2		1.16E+2
I-134	5.56E+0	1.51E+1	5.40E+0	2.62E+2	2.40E+1		1.32E-2
I-135	2.32E+1	6.08E+1	2.24E+1	4.01E+3	9.75E+1		6.87E+1
Cs-134	6.84E+3	1.63E+4	1.33E+4		5.27E+3	1.75E+3	2.85E+2
Cs-136	7.16E+2	2.83E+3	2.04E+3		1.57E+3	2.16E+2	3.21E+2
Cs-137	8.77E+3	1.20E+4	7.85E+3		4.07E+3	1.35E+3	2.32E+2
Cs-138	6.07E+0	1.20E+1	5.94E+0		8.81E+0	8.70E-1	5.12E-5
Ba-139	7.85E+0	5.59E-3	2.30E-1		5.23E-3	3.17E-3	1.39E+1
Ba-140	1.64E+3	2.06E+0	1.08E+2		7.02E-1	1.18E+0	3.38E+3
La-140	1.57E+0	7.94E-1	2.10E-1				5.83E+4
Ce-141	3.43E+0	2.32E+0	2.63E-1		1.08E+0		8.86E+3
Ce-143	6.04E-1	4.46E+2	4.94E-2		1.97E-1		1.67E+4
Ce-144	1.79E+2	7.47E+1	9.59E+0		4.43E+1		6.04E+4
Nd-147	3.96E+0	4.58E+0	2.74E-1		2.68E+0		2.20E+4
W-187	9.16E+0	7.66E+0	2.68E+0				2.51E+3
Np-239	3.53E-2	3.47E-3	1.91E-3		1.08E-2		7.11E+2

NOTE: where no value is given, no data are available.

* Source: Reg. Guide 1.109, Table E-11, Table A-1
USNRC NUREG-0172, Table 4
ICRP-30, Part 3, Supplement A

Methodology: USNRC NUREG-0133, Section 4.3.1

1.0 LIQUID EFFLUENTS (Continued)

1.6 Representative Sampling

Prior to sampling of a batch release, each batch shall be thoroughly mixed to assure representative sampling in accordance with the requirements of Regulatory Guide 1.21 and NUREG-0800, Section 11.5. The methodology for mixing and sampling is described in SO123-III-5.23, "Generating Effluent Release Permits Using The Vax Computer" and SO123-III-5.2.23, "Units 2/3 Liquid Effluent Sample Collection".

2.0 GASEOUS EFFLUENTS

2.1 DOSE RATE

SPECIFICATION

2.1.1 The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents from the site (see Figure 2-2) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and

b. For all radioiodines, tritium and for all radioactive materials in particulate form with half lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times

ACTION:

a. With dose rate(s) exceeding the above limits, immediately decrease the release rate to within the above limit(s).

SURVEILLANCE REQUIREMENTS

.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with Section 2.7.

.2 The dose rate due to radioiodines, tritium and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with Section 2.7 by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 2-1.

TABLE 2-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection ($\mu Ci/ml$)[a]
Batch Waste Gas Decay Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters[g]	$1x10^{-4}$
Continuous	*	*	Principal Gamma Emitters[g]	$1x10^{-4}$
	*	*	Tritium	$1x10^{-6}$
	Continuous[f] Sampler	W[d] Charcoal Sample	I-131	$1x10^{-12}$
			I-133	$1x10^{-10}$
	Continuous[f] Sampler	W[d] Particulate Sample	Principal Gamma Emitters[g] (I-131 and Others)	$1x10^{-11}$
	Continuous[f] Sampler	M Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
	Continuous[f] Sampler	Q Composite Particulate Sample	Sr-89 and Sr-90	$1x10^{-11}$
	Continuous[f] Monitor	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	$1x10^{-6}$

*Sampling frequencies for noble gases and tritium are:

CONTINUOUS PATHWAYS:

Containment Purge - 42"	:	Each Purge[b,c]
Containment Purge - 8"	:	Monthly Grab[b]
Condenser Air Ejector	:	Monthly Grab[b]
Plant Vent Stack	:	Weekly Grab[b,e]
South Yard Facility	:	Particulate and Iodine sampling only[h]

TABLE 2-1 (Continued)

TABLE NOTATION

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

LLD is the "a priori" lower limit of detection as defined above (as microcurie per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per transformation),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental samples).

The value of s_b used in the calculation of the LLD for a particular measurement system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance.

Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an _a priori_ (before the fact) limit representing the capability of the measurement system and not as _a posteriori_ (after the fact) limit for a particular measurement.*

*For a more complete discussion of the LLD, and other detection limits, see the following:
(1) HASL Procedures Manual, HASL-300 (revised annually).
(2) Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968).
(3) Hartwell, J. K., "Detection Limits for Radioisotopic Counting Techniques," Atlantic Richfield Hanford Company Report ARH-2537 (June 22, 1972).

TABLE 2-1 (Continued)

TABLE NOTATION

b. Analyses shall also be performed on the affected unit and plant vent stack following shutdown, startup, or a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a 1-hour period. This requirement does not apply if: (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

c. Tritium grab samples shall be taken at least once per 24 hours when the refueling canal is flooded.

d. (i) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing (or after removal from sampler).

(ii) Sampling shall also be performed on the affected unit and plant vent stack at least once per 24 hours for at least 7 days following each shutdown, startup, or a THERMAL POWER change exceeding 15 percent of RATED THERMAL POWER in 1 hour and analyses shall be completed within 48 hours of changing. This requirement does not apply if: (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement is not applicable to the South Yard Facility.

e. Tritium grab samples shall be taken at least one per 7 days from the ventilation exhaust from the spent fuel pool area, whenever spent fuel is in the spent fuel pool.

f. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Specifications 2.1, 2.2, 2.3.

g. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

h. Radioactive airborne effluents only expected to be particulate and iodine.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.2 DOSE - NOBLE GASES

SPECIFICATION

2.2.1 The air dose due to noble gases released in gaseous effluents, from each reactor unit, from the site (see Figure 2-2) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation and,

b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times

ACTION:

a. With calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission within 30 days, pursuant to Technical Specification Section 5.7.2 and LCS 5.0.104.2, a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions taken to reduce releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with Specification 2.2.1.

SURVEILLANCE REQUIREMENTS

.1 Dose Calculations Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section 2.8 at least once per 31 days.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.3 DOSE - RADIOIODINES, RADIOACTIVE MATERIALS IN PARTICULATE FORM AND TRITIUM

SPECIFICATION

2.3.1 The dose to an individual from tritium, radioiodines and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, from the Site (see Figure 2-2) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,

b. During any calendar year: Less than or equal to 15 mrem to any organ.

APPLICABILITY: At all times

ACTION:

a. With the calculated dose from the release of tritium, radioiodines, and radioactive materials in particulate form, with half lives greater than 8 days, in gaseous effluents exceeding any of the above limits, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission within 30 days pursuant to Technical Specification Section 5.7.2 and LCS 5.0.104.2, a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions taken to reduce releases and the proposed actions to be taken to assure that subsequent releases will be in compliance with Specification 2.3.1.

SURVEILLANCE REQUIREMENTS

.1 Dose Calculations Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section 2.8 at least once per 31 days.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.4 GASEOUS RADWASTE TREATMENT

SPECIFICATION

2.4.1 The GASEOUS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM shall be operable. The appropriate portions of the GASEOUS RADWASTE TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected gaseous effluent air doses due to gaseous effluent releases from the site (see Figure 2-2), when averaged over 31 days, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. The appropriate portions of the VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases from the site (see Figure 2-2) when averaged over 31 days would exceed 0.3 mrem to any organ.*

APPLICABILITY: At all times

ACTION:

a. With gaseous waste being discharged without treatment and in excess of the above limits, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission within 30 days, pursuant to Technical Specification Section 5.7.2 and LCS 5.0.104.2, a Special Report which includes the following information:

   1. Explanation of why gaseous radwaste was being discharged without treatment, identification of the inoperable equipment or subsystems and the reason for inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

SURVEILLANCE REQUIREMENTS

.1 Doses due to gaseous releases from the site shall be projected at least once per 31 days, in accordance with Section 3.2.

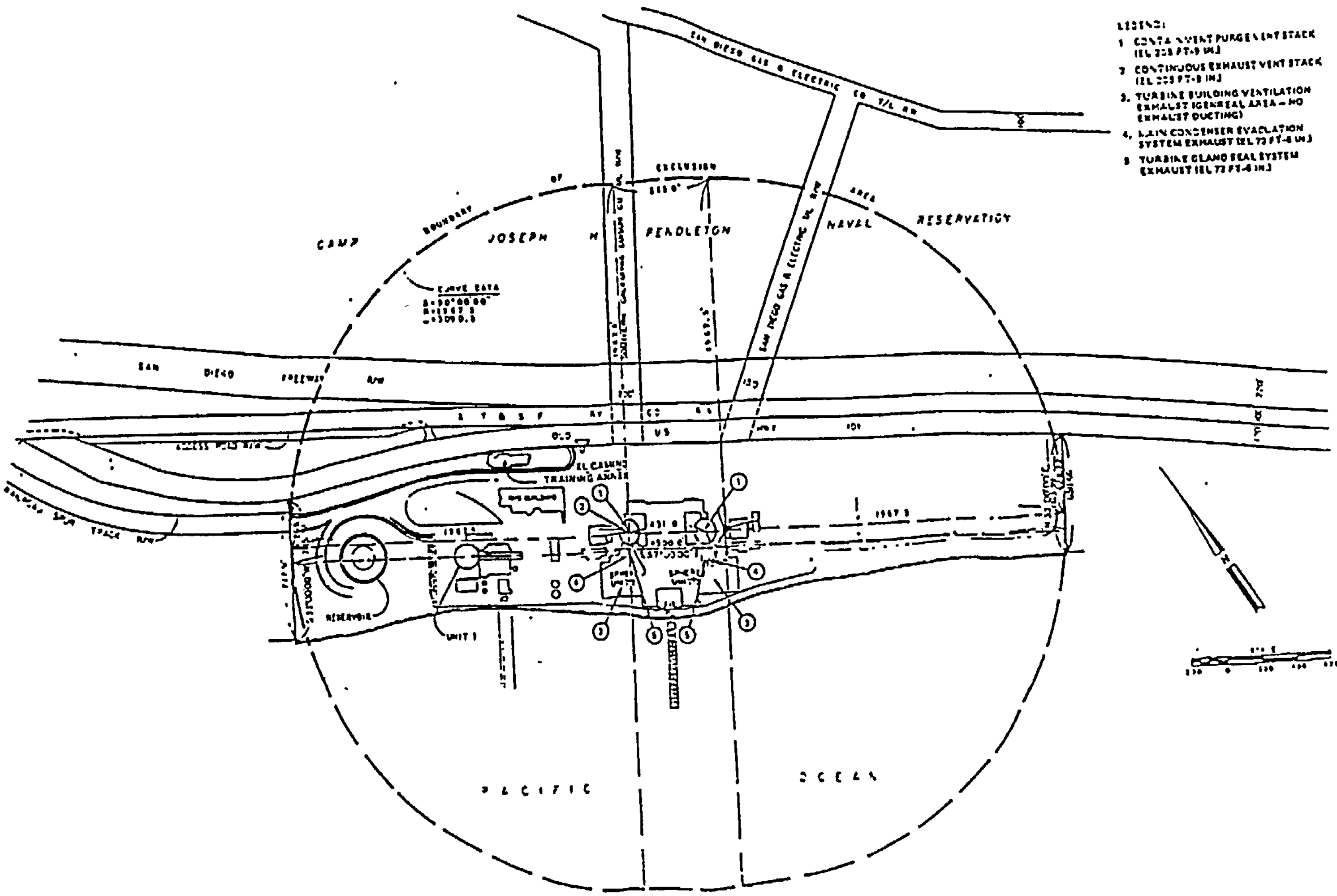
*These doses are per reactor unit.

SURVEILLANCE REQUIREMENTS (Continued)

2.4.1.2 During plant operation (Modes 1-4), the applicable portions of the GASEOUS RADWASTE TREATMENT SYSTEM and VENTILATION EXHAUST TREATMENT SYSTEM shall be demonstrated OPERABLE by operating the GASEOUS RADWASTE TREATMENT SYSTEM equipment and VENTILATION EXHAUST TREATMENT SYSTEM equipment for at least 15 minutes, at least once per 92 days unless the appropriate system has been utilized to process radioactive gaseous effluents during the previous 92 days.

.3 In plant shut-down (Mode 5, 6), the applicable portions of the GASEOUS RADWASTE TREATMENT SYSTEM and VENTILATION EXHAUST TREATMENT SYSTEM shall be demonstrated OPERABLE by operating the GASEOUS RADWASTE TREATMENT SYSTEM equipment and VENTILATION EXHAUST TREATMENT SYSTEM equipment for at least 15-minutes prior to processing gases unless the appropriate gaseous radwaste system has been utilized to process radioactive gaseous effluents during the previous 92 days.

2.5 DELETED, moved to Section 3.



SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3
SITE BOUNDARY FOR GASEOUS EFFLUENTS

Figure 2-2

2.0 <u>GASEOUS EFFLUENTS</u> (Continued)

2.6 Methods of Calculation for Gaseous Effluent Monitor Setpoints

Administrative values are used to reduce each setpoint to account for the potential activity released simultaneously from the following release points:

PVS = Plant Vent Stack
CAE = Condenser Air Ejector
CP = Containment Purge
SY = South Yard
WG = Waste Gas
U1 = Unit 1 Airborne Release

The sum of the administrative values is limited to 1.0 to ensure that the total concentration from all release points on site to the environment will not result in a release exceeding the limits of Specification 2.1.1. The sum total of all these administrative values for the site shall be less than or equal to 1.0.

The administrative values shall be periodically reviewed based on actual release data and revised as necessary.

2.6.1 PLANT VENT STACK - 2/3RT-7808, 2RT-7865-1, 3RT-7865-1

For the purpose of implementation of Specification 2.1.1, the alarm setpoint level for noble gas monitors is based on the gaseous effluent flow rate and the meteorological dispersion factor.

<u>Total Body</u>

The concentration at the detector corresponding to a 500 mrem/yr total body dose rate at the exclusion area boundary is determined by:

$$C_{det} = \frac{0.38\left(2120\,\frac{\text{cfm}}{\text{m}^3/\text{sec}}\right)(500\ \text{mrem/yr})\left(10^{-6}\ \text{m}^3/\text{cc}\right)}{(\text{flow rate, cfm})\left(X/Q,\ \text{sec/m}^3\right)\left[\sum_i\left(K_i,\ \frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \qquad \textbf{(2-1)}$$

<u>Skin</u>

The concentration at the detector corresponding to a 3000 mrem/yr skin dose rate at the exclusion area boundary is determined by:

$$C_{det} = \frac{0.38\left(2120\,\frac{\text{cfm}}{\text{m}^3/\text{sec}}\right)(3000\ \text{mrem/yr})\left(10^{-6}\text{m}^3/\text{cc}\right)}{(\text{flow rate, cfm})\left(X/Q,\text{sec/m}^3\right)\left[\sum_i\left(L_i+1.1M_i,\ \frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \qquad \textbf{(2-2)}$$

2.6.1 PLANT VENT STACK - 2/3RT-7808, 2RT-7865-1, 3RT-7865-1 (Continued)

where:

C_{det}	=	the instantaneous concentration at the detector, μCi/cc
0.38	=	an administrative value used to account for potential activity from other gaseous release pathways.
K_i	=	total body dose conversion factor from Table 2-4 for the i^{th} gamma emitting noble gas, mrem/yr per μCi/m^3
L_i	=	skin Dose Conversion Factor from Table 2-4 for the i^{th} noble gas, mrem/yr per μCi/m^3
M_i	=	air Dose Conversion Factor from Table 2-4 for the i^{th} noble gas, mrem/yr per μCi/m^3
1.1	=	conversion factor to convert gamma air dose to skin dose
C_i	=	concentration of the i^{th} noble gas as determined by sample analysis, μCi/cc
C_{tot}	=	total concentration of noble gases as determined by sample analysis, μCi/cc = $\Sigma_i C_i$
flow rate	=	total plant vent stack flow rate, cfm,
	=	typically 164,000 cfm
2120	=	conversion constant, cfm per m^3/sec
500 mrem/yr	=	total body dose rate limit, as specified by Specification 2.1.1.a
3000 mrem/yr	=	skin dose rate limit as specified by Specification 2.1.1.a
X/Q	=	historical annual average dispersion factor for any landward sector, sec/m^3
	=	4.8E-6 sec/m^3

2.6.1.1 Maximum Permissible Alarm Setpoint for 2/3RT-7808, 2RT-7865-1 and 3RT-7865-1

The smaller of the values of C_{det} from equations (2-1) and (2-2) shall be used to determine the maximum permissible monitor alarm setpoint.

The maximum release rate (μCi/sec) for Plant Vent Stack Monitors is determined by converting the concentration at the detector, C_{det} (μCi/cc) to an equivalent release rate in μCi/sec, as follows:

$$A_{max} = \frac{(C_{det}, \mu Ci/cc)(\text{flow rate, cfm})(28320)}{(S)(60)} \qquad \textbf{(2-4)}$$

where:

A_{max} = maximum permissible release rate, μCi/sec

C_{det} = smaller of the values of C_{det} determined in equations (2-1) and (2-2).

flow rate = plant vent stack flow rate (cfm) used in equations (2-1) and (2-2)

28320 = conversion from ft^3 to cc

60 = conversion from minutes to seconds

S = correction factor to compensate for the split flow between Unit 2 and Unit 3 Plant Vent Stacks, typically 2 for split stack monitoring and 1 for combined stack monitoring

The release rate setpoint shall not be set greater than the maximum release rate determined above, when the monitor is being used to meet the requirements of Specification 2.1.1.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.2 CONDENSER EVACUATION SYSTEM - 2RT-7818, 2RT-7870-1, 3RT-7818 or 3RT-7870-1

2.6.2.1 2RT-7818 and 3RT-7818 Condenser Air Ejector Monitors

For the purpose of implementation of Specification 2.1.1, the alarm setpoint level for noble gas monitors is based on the gaseous effluent flow rate and the meteorological dispersion factor.
The concentration at the detector corresponding to a total body dose rate of 500 mrem/yr at the exclusion area boundary is determined by using:

Total Body

(2-5)

$$C_{det} = \frac{(0.1)(0.5)\left(2120\ \frac{cfm}{m^3/sec}\right)(500\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(\text{Flow rate, cfm})\left(X/Q,\ sec/m^3\right)\left[\Sigma_i\left(K_i,\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]}$$

The concentration at the detector corresponding to a 3000 mrem/yr skin dose rate at the exclusion area boundary is determined by using:

Skin

where: 0.1 = an administrative value used to account for potential activity from other gaseous release pathways.

0.5 = an administrative value used to account for releases from both SONGS 2 and SONGS 3 condenser air ejectors simultaneously.

Other parameters are specified in 2.6.1.1 and 2.6.2.2 above.

(2-6)

$$C_{det} = \frac{(0.1)(0.5)\left(2120\ \frac{cfm}{m^3/sec}\right)(3000\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(\text{Flow rate, cfm})\left(X/Q,\ sec/m^3\right)\left[\Sigma_i\left(L_i + 1.1M_i,\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]}$$

2.6.2 CONDENSER EVACUATION SYSTEM - 2RT-7818, 2RT-7870-1, 3RT-7818 or 3RT-7870-1 (Continued)

The smaller of the values C_{det} from equations (2-5) or (2-6) is to be used in determining the maximum permissible monitor alarm setpoint (cpm), as follows:

The maximum permissible alarm setting (cpm) is determined by using the calibration constant for the corresponding Condenser Evacuation System Monitor given in Table 2-3. The maximum permissible alarm setpoint is the cpm value corresponding to the concentration, C_{det}, [smaller value from equation (2-5) or (2-6)].

The calibration constant used is based on Kr-85 or on Xe-133, whichever yields a lower detection efficiency (higher value in terms of μCi/cc/cpm). The alarm setpoint will not be set greater than the maximum permissible alarm setting determined above.

2.6.2.2 2RT-7870-1 and 3RT-7870-1 Wide Range Gas Monitors

The maximum release rate (μCi/sec) for Wide Range Gas Monitor is determined by converting the concentration at the detector, C_{det} (μCi/cc), to an equivalent release rate in μCi/sec.

$$A_{max} = (C_{det}, \mu Ci/cc)\ (\text{flow rate, cc/sec}) \qquad \textbf{(2-7)}$$

where:

A_{max} = maximum permissible release rate, μCi/sec

C_{det} = smaller value of C_{det}, as obtained from equations (2-5) and (2-6)

flow rate = flow rate of the condenser air ejector, cc/sec
= 4.719E5 cc/sec (conservatively assumed as design flow rate)

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.3 CONTAINMENT PURGE - 2RT-7828, 3RT-7828, 2RT-7865-1, 3RT-7865-1
For the purpose of implementation of Specification 2.1.1, the alarm setpoint level for noble gas monitors is based on the gaseous effluent flow rate and the meteorological dispersion factor.

NOTE: 2(3)RT-7865 is not designed to monitor main purge.

The concentration at the detector corresponding to a total body dose rate of 500 mrem/yr at the exclusion boundary is determined by using:

Total Body

$$C_{det2} = \frac{(0.38)(P_2)\left(2120\ \frac{cfm}{m^3/sec}\right)(500\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(Flow\ rate,\ cfm)\left(X/Q,\ sec/m^3\right)\left[\Sigma_i\left(K_i,\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \quad (2\text{-}8)$$

$$C_{det3} = \frac{(0.38)(P_3)\left(2120\ \frac{cfm}{m^3/sec}\right)(500\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(Flow\ rate,\ cfm)\left(X/Q,\ sec/m^3\right)\left[\Sigma_i\left(K_i,\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \quad (2\text{-}9)$$

The concentration at the detector corresponding to a 3000 mrem/yr skin dose rate at the exclusion area boundary is determined by using:

Skin

$$C_{det2} = \frac{(0.38)(P_2)\left(2120\ \frac{cfm}{m^3/sec}\right)(3000\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(Flow\ rate,\ cfm)\left(X/Q,\ sec/m^3\right)\left[\Sigma_i\left(L_i + 1.1M_i,\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \quad (2\text{-}10)$$

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.3 CONTAINMENT PURGE - 2RT-7828, 3RT-7828, 2RT-7865-1, 3RT-7865-1 (Continued)

$$C_{det3} = \frac{(0.38)(P_3)\left(2120\ \frac{cfm}{m^3/sec}\right)(3000\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(Flow\ rate,\ cfm)\left(X/Q,\ sec/m^3\right)\left[\Sigma_i\left(L_i + 1.1M_i,\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \quad (2\text{-}11)$$

where:

C_{det2} = instantaneous concentration of the Unit 2 detector, $\mu Ci/cc$.

C_{det3} = instantaneous concentration of the Unit 3 detector, $\mu Ci/cc$.

0.38 = administrative value used to account for potential activity from other gaseous release pathways.

P_2 and P_3 are administrative values used to account for simultaneous purges of both SONGS 2 and SONGS 3. The fractions P_2 and P_3 will be assigned such that $P_2 + P_3 \leq 1.0$.

Flow rate = observed maximum flowrate in cfm from the unit specific monitor 7828.
Default values will be the following conservative measured flows:
= 50,000 cfm main purge [2(3)RT-7828 only]
= 3,000 cfm mini-purge
(The above values replace the smaller design flowrates.)

Other parameters are as specified in 2.6.1.1 above. The smaller of the values of maximum permissible C_{det2} from equation (2-8) or (2-10) and C_{det3} from equations (2-9) or (2-11) is to be used in determining the maximum permissible monitor alarm setpoints.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.3 CONTAINMENT PURGE - 2RT-7828, 3RT-7828, 2RT-7865-1, 3RT-7865-1 (Continued)

2.6.3.1 Maximum Permissible Alarm Setting for 2(3)RT-7865-1

The maximum permissible alarm setting for the Wide Range Gas Monitor expressed as a maximum release rate (μCi/sec) is determined by converting the concentration at the detector, C_{det} (μCi/cc), to an equivalent release rate in μCi/sec.

A_{max} = (C_{det}, μCi/cc) (flow rate, cc/sec) **(2-7)**

where:

A_{max} = maximum permissible release rate, μCi/sec

C_{det} = smaller value of C_{det}, as obtained from equation (2-8, 2-10) for Unit 2 or (2-9, 2-11) for Unit 3.

flow rate = flow rate, cc/sec
= 1.416E6 cc/sec for mini-purge.
= 2.360E7 cc/sec for main purge [2(3)RT-7828 only].

.2 Maximum Permissible Alarm Setting (RT-7828)

The maximum permissible alarm setting for RT-7828 is in μCi/cc and is the smaller of the values of C_{det} (μCi/cc) from equations (2-8) and (2-10) for Unit 2 or equations (2-9) and (2-11) for Unit 3.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.4 WASTE GAS HEADER - 3RT-7865-1, 2/3RT-7808

For the purpose of Specification 2.1.1, the alarm setpoint level for noble gas monitors is based on the gaseous effluent flow rate and the meteorological dispersion factor. Since the waste gas header discharges to the plant vent stack, either 3RT-7865-1 or 2/3RT-7808 may be used to monitor waste gas header releases.

The concentration at the detector corresponding to a total body dose rate of 500 mrem/yr or a skin dose rate of 3000 mrem/yr at the exclusion area boundary is determined by using equations (2-1) or (2-2) with sample concentration (C_i) and (C_{tot}) being obtained from the waste gas decay tank to be released.

2.6.4.1 Maximum Permissible Alarm Setpoint for 3RT-7865-1 and 2/3RT-7808

The smaller of the values of C_{det} from equations (2-1) and (2-2) shall be used to determine the maximum permissible monitor alarm setpoint.

The maximum release rate (μCi/sec) for Plant Vent Stack Monitors is determined by converting the concentration at the detector, C_{det} (μCi/cc) to an equivalent release rate in μCi/sec, as follows:

$$A_{max} = \frac{(C_{det},\ \mu Ci/cc)(\text{flow rate, cfm})(28320)}{(S)(60)} \qquad (2\text{-}4)$$

where:

A_{max} = maximum permissible release rate, μCi/sec

C_{det} = smaller of the values of C_{det} determined in equations (2-1) and (2-2)

flow rate = plant vent stack flow rate (cfm) used in equations (2-1) and (2-2)

28320 = conversion from ft^3 to cc

60 = conversion from minutes to seconds

S = correction factor for 3RT-7865-1 viewing only half the total plant vent stack flow, typically 2 for 3RT-7865-1 and 1 for 2/3RT-7808.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.4 WASTE GAS HEADER - 3RT-7865-1, 2/3RT-7808 (Continued)

2.6.4.2 A release from the waste gas header is not possible if:

$$\left(\Sigma_i C_i\right)\left(\frac{f}{F}\right) > C_{det} \qquad \textbf{(2-12)}$$

where:

$\Sigma_i C_i$ = total gamma activity (μCi/cc) of the waste gas holdup tank to be released, as determined from the pre-release sample analysis

f = waste gas header effluent flow rate, cfm

F = plant vent stack flowrate (cfm) used in equations (2-1) and (2-2)

C_{det} = smaller of the values of C_{det} determined in equations (2-1) and (2-2) with C_i being obtained from the waste gas holdup tank to be released

If a release is not possible, adjust the waste gas header flow by determining the maximum permissible waste gas header effluent flow rate corresponding to the Plant Vent Stack Monitor setpoint in accordance with the following:

$$f < \frac{(0.9)(C_{det})(F)}{\Sigma_i C_i} \qquad \textbf{(2-13)}$$

where:

f = waste gas header effluent flow rate (cfm)

F = plant vent stack flow rate (cfm) used in equation (2-1) or (2-2)

C_{det} = smaller of the value of C_{det} from equation (2-1) or (2-2)

$\Sigma_i C_i$ = total gamma activity (μCi/cc) of the waste gas holdup tank to be released, as determined from the pre-release sample analysis.

0.9 = an administrative value to account for the potential activity from other releases in the same release pathway.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.6.5 SOUTH YARD FACILITY (SYF) - SYFRT7904, SYFRT7905

2.6.5.1 SYFRT7904 - South Yard Facility Work Area Monitor, SYFRT7905 - South Yard Facility Decontamination Area Monitor

For the purpose of implementation of Specification 2.1.1, the alarm setpoint level for the particulate monitor is based on the airborne effluent flow rate and the meteorological dispersion factor.

Organ Dose Rate

The concentration at the detector corresponding to a 1500 mrem/yr organ dose rate at the exclusion boundary is determined by:

$$C_{det} = \frac{(RF)(0.5)(0.1)\left(2120\ \frac{cfm}{m^3/sec}\right)(1500\ mrem/yr)\left(10^{-6}\ m^3/cc\right)}{(\text{Flow rate, cfm})\left(X/Q,\ sec/m^3\right)\left[\sum_i \left(P_{ik},\ \frac{mrem/yr}{\mu Ci/m^3}\right)\left(\frac{C_i}{C_{tot}}\right)\right]} \quad \textbf{(2-14)}$$

where:

C_{det} = the instantaneous concentration at the detector, μCi/cc

0.5 = an administrative value used to account for releases from both SYF pathways simultaneously

0.1 = an administrative value used to account for potential activity from other site airborne release pathways

P_{ik} = organ dose conversion factor from Table 2-5 for the i^{th} gamma emitting particulate isotope, mrem/yr per $\mu Ci/m^3$

C_i = concentration of the i^{th} particulate isotope as determined by sample analysis or source term evaluation, μCi/cc

RF = an administrative value used to account for isotopes in the source term that are not detectable.

2.6.5 SOUTH YARD FACILITY (SYF) - SYFRT7904, SYFRT7905 (Continued)

C_{tot}	=	total concentration of particulate isotopes as determined by sample analysis or source term evaluation, μCi/cc = $\Sigma_i C_i$
Flow Rate	=	SYF Work Area Vent cfm (typically 17,500 cfm)
	=	SYF Decontamination Monitor (typically 5,700 cfm)
2120	=	conversion constant, cfm per m^3/sec
1500 mrem/yr	=	organ dose rate limit, as specified by Specification 2.1.1.b
X/Q	=	historical annual average dispersion factor for any landward sector, 8.0E-5 sec/m^3 (Reference: Memo dated 12/11/94 from E. M. Goldin to P. K. Chang, Subject, "South Yard Facility Dispersion and Deposition Factors for Potential Normal Gaseous Effluent Releases; Determination of Compliance with 10CFR50, Appendix I")

Table 2-3[a]

Gaseous Effluent Radiation Monitor Calibration Constants
(μCi/cc/cpm)

MONITOR	Kr-85	Xe-133
2RT-7818A	4.27E-8	6.86E-8
3RT-7818A	3.73E-8	5.12E-8

[a] This table provides typical (±20%) calibration constants for the gaseous effluent radiation monitors.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.7 Gaseous Effluent Dose Rate

The methodology used for the purpose of implementation of Specification 2.1.1 for the dose rate above background to an individual in an unrestricted area is calculated by using the following expressions:

2.7.1 FOR NOBLE GASES:

(2-18)

$$\dot{D}_{TB} = \Sigma_i \left[K_i (\overline{X/Q})\, \dot{Q}_i \right]$$

(2-19)

$$\dot{D}_s = \Sigma_i \left[(L_i + 1.1 M_i)\, (\overline{X/Q})\, \dot{Q}_i \right]$$

where:

$\dot{D}_{TB}$	=	total body dose rate in unrestricted areas due to radioactive materials released in gaseous effluents, mrem/yr
$\dot{D}_s$	=	skin dose rate in unrestricted areas due to radioactive materials released in gaseous effluents, mrem/yr
K_i	=	the total body dose factor due to gamma emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrem/yr per $\mu Ci/m^3$
L_i	=	skin dose factor due to the beta emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrem/yr per $\mu Ci/m^3$
M_i	=	air dose factor due to gamma emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrad/yr per $\mu Ci/m^3$ (conversion constant of 1.1 mrem/mrad converts air dose to skin dose.)
$\dot{Q}_i$	=	measured or calculated release rate of radionuclide, i, for either continuous or batch gaseous effluents, in $\mu Ci/sec$
$(\overline{X/Q})$	=	Maximum annual average atmospheric dispersion factor for any landward sector or distance at or beyond the unrestricted area boundary.
	=	4.8E-6 sec/m^3 for Units 2 and 3
	=	8.0E-5 sec/m^3 for South Yard Facility

2.0 **GASEOUS EFFLUENTS** (Continued)

2.7.2 FOR ALL RADIOIODINES, TRITIUM AND FOR ALL RADIOACTIVE MATERIALS IN PARTICULATE FORM WITH HALF LIVES GREATER THAN EIGHT DAYS:

$$\dot{D}_o = \Sigma_i \left[\Sigma_k (P_{ik} \overline{W}_k) \dot{Q}_i\right] \qquad (2\text{-}20)$$

where:

$\dot{D}_o$ = organ dose rate in unrestricted areas due to radioactive materials released in gaseous effluents, mrem/yr

$\dot{Q}_i$ = measured or calculated release rate of radionuclide, i, for either continuous or batch gaseous effluents, μCi/sec

P_{ik} = dose parameter for radionuclide, i, for pathway, k, from Table 2-5 for the inhalation pathway in mrem/yr per $\mu Ci/m^3$. The dose factors are based on the critical individual organ and the child age group.

$\overline{W}_k$ = highest calculated annual average dispersion ($\overline{X/Q}$) or deposition ($\overline{D/Q}$) factor for estimating the dose to an individual at or beyond the unrestricted area boundary for pathway k.

= ($\overline{X/Q}$), 4.8E-6 sec/m^3 for Units 2/3 for the inhalation pathway. The location is the unrestricted area in the NW sector.

= ($\overline{X/Q}$), 8.0E-5 sec/m^3 for South Yard Facility for the inhalation pathway. The location is the unrestricted area in the E sector.

= ($\overline{D/Q}$), 4.3E-8 m^{-2} for Units 2/3 for the food and ground plane pathways. The location is the unrestricted area in the E sector.

= ($\overline{D/Q}$), 8.0E-7 m^{-2} for South Yard Facility for the food and ground plane pathways. The location is the unrestricted area in the E sector.

2.0 **GASEOUS EFFLUENTS** (Continued)

2.8 Gaseous Effluent Dose Calculation

2.8.1 DOSE FROM NOBLE GASES IN GASEOUS EFFLUENTS

The gaseous releases considered in the following dose calculations are described in Section 2.6. The air dose in unrestricted areas due to noble gases released in gaseous effluents is calculated using the following expressions:

2.8.1.1 For historical meteorology:

$$D_\gamma = 3.17\times10^{-8} \Sigma_i M_i \left[(\overline{X/Q})Q_i\right] \tag{2-21}$$

$$D_\beta = 3.17\times10^{-8} \Sigma_i N_i \left[(\overline{X/Q})Q_i\right] \tag{2-22}$$

where:

D_γ = total gamma air dose from gaseous effluents, mrad

D_β = total beta air dose from gaseous effluents, mrad

3.17×10^{-8} = inverse seconds per year

M_i = air dose factor due to gamma emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrad/yr per $\mu Ci/m^3$

N_i = air dose due to beta emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrad/yr per $\mu Ci/m^3$

$(\overline{X/Q})$ = Maximum annual average atmospheric dispersion factor for any landward sector or distance at or beyond the unrestricted area boundary.
= 4.8E-6 sec/m^3 for Units 2 and 3
= 8.0E-5 sec/m^3 for South Yard Facility

Q_i = amount of noble gas radionuclide, i, released in gaseous effluents, μCi.

2.8.1.2 For meteorology concurrent with release:

NOTE: Consistent with the methodology provided in Regulatory Guide 1.109 and the following equations, RRRGS (Radioactive Release Report Generating System) software is used to perform the actual calculations.

$$D_{\gamma\theta} = 1.14\text{x}10^{-4}\ \Sigma_i\ M_i \left[\Sigma_j (\Delta t_j\ (X/Q)_{j\theta}\ \dot{Q}_{ij})\right] \quad \textbf{(2-23)}$$

$$D_{\beta\theta} = 1.14\text{x}10^{-4}\ \Sigma_i\ N_i \left[\Sigma_j (\Delta t_j\ (X/Q)_{j\theta}\ \dot{Q}_{ij})\right] \quad \textbf{(2-24)}$$

where:

$D_{\gamma\theta}$ = total gamma air dose from gaseous effluents in sector θ, mrad

$D_{\beta\theta}$ = total beta air dose from gaseous effluents in sector θ, mrad

$1.14\text{x}10^{-4}$ = inverse hours/year

M_i = air dose factor due to gamma emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrad/yr per $\mu Ci/m^3$

N_i = air dose factor due to beta emissions from Table 2-4 for each identified noble gas radionuclide, i, in mrad/yr per $\mu Ci/m^3$

Δt_j = length of the j^{th} time period over which $(X/Q)_{j\theta}$ and $\dot{Q}_{ij}$ are averaged for gaseous releases in hours

$(X/Q)_{j\theta}$ = atmospheric dispersion factor for time period Δt_j at exclusion boundary location in landward sector θ determined by concurrent meteorology, sec/m^3

$\dot{Q}_{ij}$ = average release rate of radionuclide, i, in gaseous effluents during time period, Δt_j, $\mu Ci/sec$

2.8.2 DOSE FROM TRITIUM, RADIOIODINES AND RADIOACTIVE MATERIALS IN PARTICULATE FORM WITH HALF LIVES GREATER THAN 8 DAYS IN GASEOUS EFFLUENTS

The dose to an individual from tritium, radioiodines and radioactive materials in particulate form with half lives greater than eight days in gaseous effluents released to unrestricted areas is calculated using the following expressions:

2.8.2.1 For historical meteorology:

(2-25)

$$D_o = 3.17\text{x}10^{-8} \Sigma_i \left[\Sigma_k \left(R_{ik}W_k\right)Q_i\right]$$

where:

D_o = total projected dose from gaseous effluents to an individual, mrem

$3.17\text{x}10^{-8}$ = year/second

Q_i = amount of each radionuclide, i, (tritium, radioiodine, radioactive material in particulate form with half lives greater than eight days), released in gaseous effluents, μCi

$\Sigma_k R_{ik} W_k$ = sum of all pathways, k, for radionuclide, i, of the R_i W product, in mrem/yr per μCi/sec. The $\Sigma_k R_{ik} W_k$ value for each radionuclide, i, is given in Table 2-6 for Units 2/3 and Table 2-17 for South Yard Facility. The value given is the maximum $\Sigma_k R_{ik} W_k$ for all locations and is based on the most restrictive age groups.

R_{ik} = dose factor for each identified radionuclide, i, for pathway k, (for the inhalation pathway in mrem/yr per $\mu Ci/m^3$ and for the food and ground plane pathways in m^2-mrem/yr per μCi/sec), at the controlling location. The R_{ik}'s for each controlling location for each age group are given in Tables 2-7 thru 2-16 for Units 2/3 and Tables 2-18 through 2-21 for South Yard Facility. Data in these tables are derived using the NRC code, PARTS. (See the annual update of revised R_i parameters based on changes in the Land Use Census provided by Corporate Health Physics and Environmental.)

2.0 **GASEOUS EFFLUENTS** (Continued)

2.8.2.1 For historical meteorology: (Continued)

W_k = annual average dispersion $(\overline{X/Q})$ or deposition $(\overline{D/Q})$ factor for estimating the dose to an individual at the controlling location for pathway k.

= $(\overline{X/Q})$ for the inhalation pathway in sec/m^3. The $(\overline{X/Q})$ for each controlling location is given in Tables 2-7 thru 2-16 for Units 2/3 and Table 2-18 through 2-21 for South Yard Facility.

= $(\overline{D/Q})$ for the food and ground plane pathways in m^{-2}. The $(\overline{D/Q})$ for each controlling location is given in Tables 2-7 thru 2-16 for Units 2/3 and Tables 2-18 through 2-21 for South Yard Facility.

2.8.2.2 For meteorology concurrent with releases:

NOTE: Consistent with the methodology provided in Regulatory Guide 1.109 and the following equations, RRRGS (Radioactive Release Report Generating System) software is used to perform the actual calculations.

$$D_\theta = 1.14 \times 10^{-4} \sum_{i}^{l}\sum_{j}^{m}\sum_{k}^{n} \left[(\Delta t_j)(R_{ik\theta})(W_{jk\theta})\left(\dot{Q}_{ij}\right) \right] \quad (2\text{-}26)$$

where:

D_θ = total annual dose from gaseous effluents to an individual in sector θ, mrem.

Δt_j = length of the jth period over which $W_{jk\theta}$ and $\dot{Q}_{ij}$ are averaged for gaseous released, hours

$\dot{Q}_{ij}$ = average release rate of radionuclide, i, in gaseous effluents during time period Δt_j, μCi/sec

$R_{ik\theta}$ = dose factor for each identified radionuclide i, for pathway k for sector θ (for the inhalation pathway in mrem/yr per μCi/m^3 and for the food and ground plane pathways in m^2 mrem/yr per μCi/sec) at the controlling location. A listing of R_{ik} for the controlling locations in each landward sector for each group is given in Tables 2-7 thru 2-16 for Units 2/3 and Tables 2-18 through 2-21 for South Yard Facility. The θ is determined by the concurrent meteorology.

$W_{jk\theta}$ = dispersion $(\overline{X/Q})$ or deposition $(\overline{D/Q})$ factor for the time period Δt_j for each pathway k for calculating the dose to an individual at the controlling location in sector θ using concurrent meteorological conditions.
= $(\overline{X/Q})$ for the inhalation pathway, sec/m^3
= $(\overline{D/Q})$ for the food and ground plane pathways, m^{-2}

TABLE 2-4

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS**

Radio-Nuclide	Total Body Dose Factor K_i (mrem/yr per $\mu Ci/m^3$)	Skin Dose Factor L_i (mrem/yr per $\mu Ci/m^3$)	Gamma Air Dose Factor M_i (mrad/yr per $\mu Ci/m^3$)	Beta Air Dose Factor N_i (mrad/yr per $\mu Ci/m^3$)
Kr-85m	1.17E+3	1.46E+3	1.23E+3	1.97E+3
Kr-85	1.61E+1	1.34E+3	1.72E+1	1.95E+3
Kr-87	5.92E+3	9.73E+3	6.17E+3	1.03E+4
Kr-88	1.47E+4	2.37E+3	1.52E+4	2.93E+3
Xe-131m	9.15E+1	4.76E+2	1.56E+2	1.11E+3
Xe-133m	2.51E+2	9.94E+2	3.27E+2	1.48E+3
Xe-133	2.94E+2	3.06E+2	3.53E+2	1.05E+3
Xe-135m	3.12E+3	7.11E+2	3.36E+3	7.39E+2
Xe-135	1.81E+3	1.86E+3	1.92E+3	2.46E+3
Xe-138	8.83E+3	4.13E+3	9.21E+3	4.75E+3
Ar-41	8.84E+3	2.69E+3	9.30E+3	3.28E+3

**Source: USNRC Reg. Guide 1.109, Table B-1

TABLE 2-5

DOSE PARAMETER P_{ik}*

CHILD AGE GROUP
CRITICAL ORGAN

Radionuclide	Inhalation Pathway (mrem/yr per $\mu Ci/m^3$)	Radionuclide	Inhalation Pathway (mrem/yr per $\mu Ci/m^3$)
H - 3	1.1E+3	I -131	1.6E+7
Cr-51	1.7E+4	I -132	1.9E+5
Mn-54	1.6E+6	I -133	3.8E+6
Co-57	5.1E+5	I -134	5.1E+4
Co-58	1.1E+6	I -135	7.9E+5
Co-60	7.1E+6	Cs-134	1.0E+6
Sr-89	2.2E+6	Cs-136	1.7E+5
Sr-90	1.0E+8	Cs-137	9.1E+5
Zr-95	2.2E+6	Ba-140	1.7E+6
Nb-95	6.1E+5	Ce-141	5.4E+5
Ru-103	6.6E+5	Ce-144	1.2E+7
Te-129m	1.8E+6		

*Source: USNRC NUREG-0133, Section 5.2.1.1

TABLE 2-6

CONTROLLING LOCATION FACTORS

Radionuclide	$\Sigma_k R_{ik} W_k$ mrem/yr per μCi/sec	Use:
H -3	1.55E-3	R: Outage Workers
Cr-51	6.34E-2	R: Outage Workers
Mn-54	1.39E+1	R: Outage Workers
Co-57	3.49E+0	R: Outage Workers
Co-58	4.91E+0	R: Outage Workers
Co-60	1.91E+2	R: Outage Workers
Sr-89	4.65E+1	Q: SC Ranch (No. Res.)
Sr-90	1.95E+3	Q: SC Ranch (No. Res.)
Zr-95	5.43E+0	R: Outage Workers
Nb-95	1.07E+1	E: Deer Consumer/Hunter
Ru-103	1.69E+1	E: Deer Consumer/Hunter
Te-129m	8.35E+0	E: Deer Consumer/Hunter
Cs-134	5.89E+1	R: Outage Workers
Cs-136	1.49E+0	R: Outage Workers
Cs-137	8.61E+1	R: Outage Workers
Ba-140	2.69E+0	R: Outage Workers
Ce-141	8.53E-1	R: Outage Workers
Ce-144	1.80E+1	Q: SC Ranch (No. Res.)
I -131	2.48E+1	Q: SC Res. w/Garden
I -132	2.47E-1	R: Outage Workers
I -133	4.83E+0	R: Outage Workers
I -134	6.67E-2	R: Outage Workers
I -135	9.83E-1	R: Outage Workers
UN-ID	7.77E+0	R: Outage Workers

Footnote: These values to be used in manual calculations are the maximum $\Sigma_k R_{ik} W_k$ for all locations based on the most restrictive age group.

TABLE 2-7

DOSE PARAMETER R_i FOR SECTOR P

Pathway = Cotton Point Estates with Garden   Distance = 2.8 miles
X/Q = 1.0E-7 sec/m³   D/Q = 3.0E-10 m⁻²

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	4.0E+3	1.3E+3	2.6E+3	1.3E+3	2.3E+3
Cr-51	1.3E+4	4.7E+6	1.7E+4	1.1E+7	2.1E+4	1.5E+7	1.4E+4	1.6E+7
Mn-54	1.0E+6	1.4E+9	1.6E+6	2.0E+9	2.0E+6	2.3E+9	1.4E+6	2.3E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	5.8E+8	5.9E+5	6.6E+8	3.7E+5	6.3E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	7.5E+8	1.3E+6	9.7E+8	9.3E+5	9.9E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.4E+10	8.7E+6	2.5E+10	6.0E+6	2.5E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	3.5E+10	2.4E+6	1.5E+10	1.4E+6	9.8E+9
Sr-90	4.1E+7	-0-	1.0E+8	1.4E+12	1.1E+8	8.3E+11	9.9E+7	6.7E+11
Zr-95	1.8E+6	2.5E+8	2.2E+6	1.1E+9	2.7E+6	1.5E+9	1.8E+6	1.4E+9
Nb-95	4.8E+5	1.4E+8	6.1E+5	4.3E+8	7.5E+5	5.9E+8	5.0E+5	6.1E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	5.0E+8	7.8E+5	6.8E+8	5.0E+5	6.6E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.9E+9	2.0E+6	1.8E+9	1.2E+6	1.5E+9
Cs-134	7.0E+5	6.8E+9	1.0E+6	3.2E+10	1.1E+6	2.3E+10	8.5E+5	1.8E+10
Cs-136	1.3E+5	1.5E+8	1.7E+5	3.7E+8	1.9E+5	3.2E+8	1.5E+5	3.2E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	3.5E+10	8.5E+5	2.4E+10	6.2E+5	1.9E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	3.0E+8	2.0E+6	2.3E+8	1.3E+6	2.8E+8
Ce-141	5.2E+5	1.4E+7	5.4E+5	4.2E+8	6.1E+5	5.5E+8	3.6E+5	5.2E+8
Ce-144	9.8E+6	7.0E+7	1.2E+7	1.0E+10	1.3E+7	1.3E+10	7.8E+6	1.1E+10
I -131	1.5E+7	1.7E+7	1.6E+7	4.8E+10	1.5E+7	3.1E+10	1.2E+7	3.8E+10
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	8.1E+8	2.9E+6	4.6E+8	2.2E+6	5.3E+8
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	1.2E+7	6.2E+5	8.2E+6	4.5E+5	9.1E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	3.5E+9	1.2E+6	2.6E+9	8.6E+5	2.0E+9

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-7

DOSE PARAMETER R_i FOR SECTOR P

Pathway = 51 Area Beach Check-In   Distance = 1.4 miles
X/Q = 6.9E-07 sec/m^3 D/Q = 3.3E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+3	1.2E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	3.6E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	9.5E+4	8.8E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	9.8E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+6	5.5E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	5.5E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	6.5E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+5	3.5E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+5	2.8E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+5	5.1E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+5	1.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	3.8E+4	3.9E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.6E+5	2.6E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+5	5.3E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+4	3.5E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+6	1.8E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+6	4.4E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+4	3.2E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	5.5E+5	6.3E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	7.7E+3	1.2E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	6.5E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+5	1.9E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = San Onofre Mobile Homes   Distance = 1.4 miles
X/Q = 6.9E-7 sec/m^3 D/Q = 3.3E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	-0-	1.3E+3	-0-	1.3E+3	-0-
Cr-51	1.3E+4	4.7E+6	1.7E+4	4.7E+6	2.1E+4	4.7E+6	1.4E+4	4.7E+6
Mn-54	1.0E+6	1.4E+9	1.6E+6	1.4E+9	2.0E+6	1.4E+9	1.4E+6	1.4E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	3.4E+8	5.9E+5	3.4E+8	3.7E+5	3.4E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	3.8E+8	1.3E+6	3.8E+8	9.3E+5	3.8E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.2E+10	8.7E+6	2.2E+10	6.0E+6	2.2E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	2.2E+4	2.4E+6	2.2E+4	1.4E+6	2.2E+4
Sr-90	4.1E+7	-0-	1.0E+8	-0-	1.1E+8	-0-	9.9E+7	-0-
Zr-95	1.8E+6	2.5E+8	2.2E+6	2.5E+8	2.7E+6	2.5E+8	1.8E+6	2.5E+8
Nb-95	4.8E+5	1.4E+8	6.1E+5	1.4E+8	7.5E+5	1.4E+8	5.0E+5	1.4E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	1.1E+8	7.8E+5	1.1E+8	5.0E+5	1.1E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.0E+7	2.0E+6	2.0E+7	1.2E+6	2.0E+7
Cs-134	7.0E+5	6.8E+9	1.0E+6	6.8E+9	1.1E+6	6.8E+9	8.5E+5	6.8E+9
Cs-136	1.3E+5	1.5E+8	1.7E+5	1.5E+8	1.9E+5	1.5E+8	1.5E+5	1.5E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	1.0E+10	8.5E+5	1.0E+10	6.2E+5	1.0E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	2.1E+7	2.0E+6	2.1E+7	1.3E+6	2.1E+7
Ce-141	5.2E+5	1.4E+7	5.4E+5	1.4E+7	6.1E+5	1.4E+7	3.6E+5	1.4E+7
Ce-144	9.8E+6	7.0E+7	1.2E+7	7.0E+7	1.3E+7	7.0E+7	7.8E+6	7.0E+7
I -131	1.5E+7	1.7E+7	1.6E+7	1.7E+7	1.5E+7	1.7E+7	1.2E+7	1.7E+7
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	2.4E+6	2.9E+6	2.4E+6	2.2E+6	2.4E+6
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	2.5E+6	6.2E+5	2.5E+6	4.5E+5	2.5E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	7.5E+8	1.2E+6	7.5E+8	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = S. C. Resident With Garden — Distance = 4.1 miles
X/Q = 1.4E-7 sec/m³ — D/Q = 4.7E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	4.0E+3	1.3E+3	2.6E+3	1.3E+3	2.3E+3
Cr-51	1.3E+4	4.7E+6	1.7E+4	1.1E+7	2.1E+4	1.5E+7	1.4E+4	1.6E+7
Mn-54	1.0E+6	1.4E+9	1.6E+6	2.0E+9	2.0E+6	2.3E+9	1.4E+6	2.3E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	5.8E+8	5.9E+5	6.6E+8	3.7E+5	6.3E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	7.5E+8	1.3E+6	9.7E+8	9.3E+5	9.9E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.4E+10	8.7E+6	2.5E+10	6.0E+6	2.5E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	3.5E+10	2.4E+6	1.5E+10	1.4E+6	9.8E+9
Sr-90	4.1E+7	-0-	1.0E+8	1.4E+12	1.1E+8	8.3E+11	9.9E+7	6.7E+11
Zr-95	1.8E+6	2.5E+8	2.2E+6	1.1E+9	2.7E+6	1.5E+9	1.8E+6	1.4E+9
Nb-95	4.8E+5	1.4E+8	6.1E+5	4.3E+8	7.5E+5	5.9E+8	5.0E+5	6.1E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	5.0E+8	7.8E+5	6.8E+8	5.0E+5	6.6E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.9E+9	2.0E+6	1.8E+9	1.2E+6	1.5E+9
Cs-134	7.0E+5	6.8E+9	1.0E+6	3.2E+10	1.1E+6	2.3E+10	8.5E+5	1.8E+10
Cs-136	1.3E+5	1.5E+8	1.7E+5	3.7E+8	1.9E+5	3.2E+8	1.5E+5	3.2E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	3.5E+10	8.5E+5	2.4E+10	6.2E+5	1.9E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	3.0E+8	2.0E+6	2.3E+8	1.3E+6	2.8E+8
Ce-141	5.2E+5	1.4E+7	5.4E+5	4.2E+8	6.1E+5	5.5E+8	3.6E+5	5.2E+8
Ce-144	9.8E+6	7.0E+7	1.2E+7	1.0E+10	1.3E+7	1.3E+10	7.8E+6	1.1E+10
I -131	1.5E+7	1.7E+7	1.6E+7	4.8E+10	1.5E+7	3.1E+10	1.2E+7	3.8E+10
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	8.1E+8	2.9E+6	4.6E+8	2.2E+6	5.3E+8
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	1.2E+7	6.2E+5	8.2E+6	4.5E+5	9.1E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	3.5E+9	1.2E+6	2.6E+9	8.6E+5	2.0E+9

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = San Clemente Ranch (No Residents)   Distance = 2.2 miles
X/Q = 3.5E-7 sec/m^3 D/Q = 1.5E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	3.8E+3	-0-	2.4E+3	3.6E+2	1.9E+3
Cr-51	-0-	-0-	-0-	4.8E+6	-0-	7.4E+6	4.1E+3	8.1E+6
Mn-54	-0-	-0-	-0-	6.1E+8	-0-	8.3E+8	4.0E+5	1.2E+9
Co-57	-0-	-0-	-0-	2.2E+8	-0-	2.9E+8	1.1E+5	3.4E+8
Co-58	-0-	-0-	-0-	3.3E+8	-0-	5.1E+8	2.6E+5	5.8E+8
Co-60	-0-	-0-	-0-	2.0E+9	-0-	3.0E+9	1.7E+6	8.8E+9
Sr-89	-0-	-0-	-0-	3.1E+10	-0-	1.2E+10	4.0E+5	7.2E+9
Sr-90	-0-	-0-	-0-	1.3E+12	-0-	7.7E+11	2.8E+7	5.8E+11
Zr-95	-0-	-0-	-0-	7.8E+8	-0-	1.1E+9	5.0E+5	9.8E+8
Nb-95	-0-	-0-	-0-	2.4E+8	-0-	3.5E+8	1.4E+5	3.5E+8
Ru-103	-0-	-0-	-0-	3.3E+8	-0-	4.5E+8	1.4E+5	4.1E+8
Te-129m	-0-	-0-	-0-	2.3E+9	-0-	1.4E+9	3.3E+5	9.5E+8
Cs-134	-0-	-0-	-0-	2.4E+10	-0-	1.5E+10	2.4E+5	1.1E+10
Cs-136	-0-	-0-	-0-	9.0E+7	-0-	5.7E+7	4.2E+4	7.9E+7
Cs-137	-0-	-0-	-0-	2.3E+10	-0-	1.3E+10	1.8E+5	1.1E+10
Ba-140	-0-	-0-	-0-	1.1E+8	-0-	6.8E+7	3.6E+5	5.9E+7
Ce-141	-0-	-0-	-0-	3.3E+8	-0-	4.1E+8	1.0E+5	3.2E+8
Ce-144	-0-	-0-	-0-	9.2E+9	-0-	1.2E+10	2.2E+6	9.0E+9
I -131	-0-	-0-	-0-	4.1E+9	-0-	2.1E+9	3.4E+6	1.4E+9
I -132	-0-	-0-	-0-	6.0E-36	-0-	2.6E-36	3.3E+4	3.5E+5
I -133	-0-	-0-	-0-	4.0E-11	-0-	1.7E-11	6.1E+5	7.0E+5
I -134	-0-	-0-	-0-	6.1E-37	-0-	2.7E-37	8.5E+3	1.3E+5
I -135	-0-	-0-	-0-	7.0E-35	-0-	3.1E-35	1.3E+5	7.2E+5
UN-ID	-0-	-0-	-0-	2.5E+9	-0-	1.7E+9	2.5E+5	1.3E+9

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = Outage Workers Distance = 0.7 miles
X/Q = 2.0E-6 sec/m^3 D/Q = 1.1E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -131	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -132	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -133	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -134	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -135	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = San Mateo Pt Homes   Distance = 2.7 miles
X/Q = 2.6E-7 sec/m^3 D/Q = 1.0E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	-0-	1.3E+3	-0-	1.3E+3	-0-
Cr-51	1.3E+4	4.7E+6	1.7E+4	4.7E+6	2.1E+4	4.7E+6	1.4E+4	4.7E+6
Mn-54	1.0E+6	1.4E+9	1.6E+6	1.4E+9	2.0E+6	1.4E+9	1.4E+6	1.4E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	3.4E+8	5.9E+5	3.4E+8	3.7E+5	3.4E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	3.8E+8	1.3E+6	3.8E+8	9.3E+5	3.8E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.2E+10	8.7E+6	2.2E+10	6.0E+6	2.2E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	2.2E+4	2.4E+6	2.2E+4	1.4E+6	2.2E+4
Sr-90	4.1E+7	-0-	1.0E+8	-0-	1.1E+8	-0-	9.9E+7	-0-
Zr-95	1.8E+6	2.5E+8	2.2E+6	2.5E+8	2.7E+6	2.5E+8	1.8E+6	2.5E+8
Nb-95	4.8E+5	1.4E+8	6.1E+5	1.4E+8	7.5E+5	1.4E+8	5.0E+5	1.4E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	1.1E+8	7.8E+5	1.1E+8	5.0E+5	1.1E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.0E+7	2.0E+6	2.0E+7	1.2E+6	2.0E+7
Cs-134	7.0E+5	6.8E+9	1.0E+6	6.8E+9	1.1E+6	6.8E+9	8.5E+5	6.8E+9
Cs-136	1.3E+5	1.5E+8	1.7E+5	1.5E+8	1.9E+5	1.5E+8	1.5E+5	1.5E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	1.0E+10	8.5E+5	1.0E+10	6.2E+5	1.0E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	2.1E+7	2.0E+6	2.1E+7	1.3E+6	2.1E+7
Ce-141	5.2E+5	1.4E+7	5.4E+5	1.4E+7	6.1E+5	1.4E+7	3.6E+5	1.4E+7
Ce-144	9.8E+6	7.0E+7	1.2E+7	7.0E+7	1.3E+7	7.0E+7	7.8E+6	7.0E+7
I -131	1.5E+7	1.7E+7	1.6E+7	1.7E+7	1.5E+7	1.7E+7	1.2E+7	1.7E+7
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	2.4E+6	2.9E+6	2.4E+6	2.2E+6	2.4E+6
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	2.5E+6	6.2E+5	2.5E+6	4.5E+5	2.5E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	7.5E+8	1.2E+6	7.5E+8	8.6E+5	7.5E+8

F

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

DOSE PARAMETER R_i FOR SECTOR R

Pathway = San Onofre Mobile Homes   Distance = 1.3 miles
X/Q = 5.2E-7 sec/m^3 D/Q = 3.0E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	-0-	1.3E+3	-0-	1.3E+3	-0-
Cr-51	1.3E+4	4.7E+6	1.7E+4	4.7E+6	2.1E+4	4.7E+6	1.4E+4	4.7E+6
Mn-54	1.0E+6	1.4E+9	1.6E+6	1.4E+9	2.0E+6	1.4E+9	1.4E+6	1.4E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	3.4E+8	5.9E+5	3.4E+8	3.7E+5	3.4E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	3.8E+8	1.3E+6	3.8E+8	9.3E+5	3.8E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.2E+10	8.7E+6	2.2E+10	6.0E+6	2.2E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	2.2E+4	2.4E+6	2.2E+4	1.4E+6	2.2E+4
Sr-90	4.1E+7	-0-	1.0E+8	-0-	1.1E+8	-0-	9.9E+7	-0-
Zr-95	1.8E+6	2.5E+8	2.2E+6	2.5E+8	2.7E+6	2.5E+8	1.8E+6	2.5E+8
Nb-95	4.8E+5	1.4E+8	6.1E+5	1.4E+8	7.5E+5	1.4E+8	5.0E+5	1.4E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	1.1E+8	7.8E+5	1.1E+8	5.0E+5	1.1E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.0E+7	2.0E+6	2.0E+7	1.2E+6	2.0E+7
Cs-134	7.0E+5	6.8E+9	1.0E+6	6.8E+9	1.1E+6	6.8E+9	8.5E+5	6.8E+9
Cs-136	1.3E+5	1.5E+8	1.7E+5	1.5E+8	1.9E+5	1.5E+8	1.5E+5	1.5E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	1.0E+10	8.5E+5	1.0E+10	6.2E+5	1.0E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	2.1E+7	2.0E+6	2.1E+7	1.3E+6	2.1E+7
Ce-141	5.2E+5	1.4E+7	5.4E+5	1.4E+7	6.1E+5	1.4E+7	3.6E+5	1.4E+7
Ce-144	9.8E+6	7.0E+7	1.2E+7	7.0E+7	1.3E+7	7.0E+7	7.8E+6	7.0E+7
I -131	1.5E+7	1.7E+7	1.6E+7	1.7E+7	1.5E+7	1.7E+7	1.2E+7	1.7E+7
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	2.4E+6	2.9E+6	2.4E+6	2.2E+6	2.4E+6
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	2.5E+6	6.2E+5	2.5E+6	4.5E+5	2.5E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	7.5E+8	1.2E+6	7.5E+8	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-9

DOSE PARAMETER R_i FOR SECTOR R

Pathway = San Clemente Ranch (No Residents)   Distance = 2.3 miles
X/Q = 2.1E-7 sec/m^3 D/Q = 1.1E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	3.8E+3	-0-	2.4E+3	3.6E+2	1.9E+3
Cr-51	-0-	-0-	-0-	4.8E+6	-0-	7.4E+6	4.1E+3	8.1E+6
Mn-54	-0-	-0-	-0-	6.1E+8	-0-	8.3E+8	4.0E+5	1.2E+9
Co-57	-0-	-0-	-0-	2.2E+8	-0-	2.9E+8	1.1E+5	3.4E+8
Co-58	-0-	-0-	-0-	3.3E+8	-0-	5.1E+8	2.6E+5	5.8E+8
Co-60	-0-	-0-	-0-	2.0E+9	-0-	3.0E+9	1.7E+6	8.8E+9
Sr-89	-0-	-0-	-0-	3.1E+10	-0-	1.2E+10	4.0E+5	7.2E+9
Sr-90	-0-	-0-	-0-	1.3E+12	-0-	7.7E+11	2.8E+7	5.8E+11
Zr-95	-0-	-0-	-0-	7.8E+8	-0-	1.1E+9	5.0E+5	9.8E+8
Nb-95	-0-	-0-	-0-	2.4E+8	-0-	3.5E+8	1.4E+5	3.5E+8
Ru-103	-0-	-0-	-0-	3.3E+8	-0-	4.5E+8	1.4E+5	4.1E+8
Te-129m	-0-	-0-	-0-	2.3E+9	-0-	1.4E+9	3.3E+5	9.5E+8
Cs-134	-0-	-0-	-0-	2.4E+10	-0-	1.5E+10	2.4E+5	1.1E+10
Cs-136	-0-	-0-	-0-	9.0E+7	-0-	5.7E+7	4.2E+4	7.9E+7
Cs-137	-0-	-0-	-0-	2.3E+10	-0-	1.3E+10	1.8E+5	1.1E+10
Ba-140	-0-	-0-	-0-	1.1E+8	-0-	6.8E+7	3.6E+5	5.9E+7
Ce-141	-0-	-0-	-0-	3.3E+8	-0-	4.1E+8	1.0E+5	3.2E+8
Ce-144	-0-	-0-	-0-	9.2E+9	-0-	1.2E+10	2.2E+6	9.0E+9
I -131	-0-	-0-	-0-	4.1E+9	-0-	2.1E+9	3.4E+6	1.4E+9
I -132	-0-	-0-	-0-	6.0E-36	-0-	2.6E-36	3.3E+4	3.5E+5
I -133	-0-	-0-	-0-	4.0E-11	-0-	1.7E-11	6.1E+5	7.0E+5
I -134	-0-	-0-	-0-	6.1E-37	-0-	2.7E-37	8.5E+3	1.3E+5
I -135	-0-	-0-	-0-	7.0E-35	-0-	3.1E-35	1.3E+5	7.2E+5
UN-ID	-0-	-0-	-0-	2.5E+9	-0-	1.7E+9	2.5E+5	1.3E+9

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-9

DOSE PARAMETER R_i FOR SECTOR R

Pathway = Outage Workers
X/Q = 3.7E-6 sec/m^3

Distance = 0.4 miles
D/Q = 2.5E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	2.2E+2	-0-	3.7E+2	-0-	4.2E+2	-0-	4.2E+2	-0-
Cr-51	4.3E+3	1.5E+6	5.7E+3	1.5E+6	7.0E+3	1.5E+6	4.8E+3	1.5E+6
Mn-54	3.3E+5	4.6E+8	5.3E+5	4.6E+8	6.6E+5	4.6E+8	4.7E+5	4.6E+8
Co-57	1.3E+5	1.1E+8	1.7E+5	1.1E+8	2.0E+5	1.1E+8	1.2E+5	1.1E+8
Co-58	2.6E+5	1.3E+8	3.7E+5	1.3E+8	4.5E+5	1.3E+8	3.1E+5	1.3E+8
Co-60	1.5E+6	7.2E+9	2.4E+6	7.2E+9	2.9E+6	7.2E+9	2.0E+6	7.2E+9
Sr-89	6.8E+5	7.2E+3	7.2E+5	7.2E+3	8.1E+5	7.2E+3	4.7E+5	7.2E+3
Sr-90	1.4E+7	-0-	3.4E+7	-0-	3.6E+7	-0-	3.3E+7	-0-
Zr-95	5.8E+5	8.4E+7	7.4E+5	8.4E+7	9.0E+5	8.4E+7	5.9E+5	8.4E+7
Nb-95	1.6E+5	4.6E+7	2.0E+5	4.6E+7	2.5E+5	4.6E+7	1.7E+5	4.6E+7
Ru-103	1.8E+5	3.6E+7	2.2E+5	3.6E+7	2.6E+5	3.6E+7	1.7E+5	3.6E+7
Te-129m	5.6E+5	6.6E+6	5.9E+5	6.6E+6	6.6E+5	6.6E+6	3.9E+5	6.6E+6
Cs-134	2.3E+5	2.3E+9	3.4E+5	2.3E+9	3.8E+5	2.3E+9	2.8E+5	2.3E+9
Cs-136	4.5E+4	5.0E+7	5.7E+4	5.0E+7	6.5E+4	5.0E+7	4.9E+4	5.0E+7
Cs-137	2.0E+5	3.4E+9	3.0E+5	3.4E+9	2.8E+5	3.4E+9	2.1E+5	3.4E+9
Ba-140	5.3E+5	6.8E+6	5.8E+5	6.8E+6	6.8E+5	6.8E+6	4.2E+5	6.8E+6
Ce-141	1.7E+5	4.5E+6	1.8E+5	4.5E+6	2.0E+5	4.5E+6	1.2E+5	4.5E+6
Ce-144	3.3E+6	2.3E+7	4.0E+6	2.3E+7	4.5E+6	2.3E+7	2.6E+6	2.3E+7
I -131	4.9E+6	5.7E+6	5.4E+6	5.7E+6	4.9E+6	5.7E+6	4.0E+6	5.7E+6
I -132	5.6E+4	4.1E+5	6.4E+4	4.1E+5	5.0E+4	4.1E+5	3.8E+4	4.1E+5
I -133	1.2E+6	8.2E+5	1.3E+6	8.2E+5	9.7E+5	8.2E+5	7.2E+5	8.2E+5
I -134	1.5E+4	1.5E+5	1.7E+4	1.5E+5	1.3E+4	1.5E+5	9.9E+3	1.5E+5
I -135	2.3E+5	8.4E+5	2.6E+5	8.4E+5	2.1E+5	8.4E+5	1.5E+5	8.4E+5
UN-ID	2.2E+5	2.5E+8	3.3E+5	2.5E+8	4.1E+5	2.5E+8	2.9E+5	2.5E+8

R

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-10

DOSE PARAMETER R_i FOR SECTOR A

Pathway = Camp San Mateo   Distance = 3.6 miles
X/Q = 7.2E-8 sec/m^3 D/Q = 4.1E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-11

DOSE PARAMETER R_i FOR SECTOR B

Pathway = Deer Consumer/Hunter — Distance = 3.8 miles
X/Q = 6.8E-8 sec/m^3 — D/Q = 5.1E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-11

DOSE PARAMETER R_i FOR SECTOR B

Pathway = Sanitary Landfill
X/Q = 1.3E-7 sec/m^3

Distance = 2.1 miles
D/Q = 1.1E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+3	1.1E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+5	3.2E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	8.4E+4	7.8E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	2.1E+5	8.7E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	4.9E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+5	4.9E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	2.3E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	4.0E+5	5.7E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	3.1E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	2.5E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+5	4.5E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	1.9E+5	1.6E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+4	3.4E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+5	2.3E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+5	4.7E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	8.3E+4	3.1E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	1.6E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.7E+6	3.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+4	2.8E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	4.9E+5	5.6E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	6.8E+3	1.0E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+5	5.8E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	1.7E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-12

DOSE PARAMETER R_i FOR SECTOR C

Pathway = Camp San Onofre — Distance = 2.6 miles
X/Q = 9.7E-8 sec/m^3 — D/Q = 8.9E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-12

DOSE PARAMETER R_i FOR SECTOR C

Pathway = Deer Consumer/Hunter   Distance = 1.0 miles
X/Q = 4.0E-7 sec/m³   D/Q = 4.6E-9 m⁻²

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-13

DOSE PARAMETER R_i FOR SECTOR D

Pathway = Camp San Onofre — Distance = 3.0 miles
X/Q = 6.9E-8 sec/m^3 — D/Q = 7.2E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-13

DOSE PARAMETER R_i FOR SECTOR D

Pathway = Deer Consumer/Hunter   Distance = 0.8 miles
X/Q = 5.3E-7 sec/m³   D/Q = 7.3E-9 m⁻²

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

DOSE PARAMETER R_i FOR SECTOR E

Pathway = Camp Horno   Distance = 4.1 miles
X/Q = 7.5E-8 sec/m^3 D/Q = 7.2E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-14

DOSE PARAMETER R_i FOR SECTOR E

Pathway = Deer Consumer/Hunter — Distance = 0.8 miles
X/Q = 8.5E-7 sec/m^3 — D/Q = 1.3E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-15

DOSE PARAMETER R_i FOR SECTOR F

Pathway = San Onofre State Park/Guard Shack   Distance = 0.8 miles
X/Q = 9.6E-7 sec/m^3 D/Q = 8.4E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+3	8.0E+5
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	2.4E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	6.3E+4	5.9E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	1.6E+5	6.5E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+6	3.7E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	3.7E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	1.7E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+5	4.3E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	2.3E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	1.9E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	3.4E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.2E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+4	2.6E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.8E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+5	3.5E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+4	2.3E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	1.2E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+6	2.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+4	2.1E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	4.2E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	5.1E+3	7.7E+4
I -135	-0-	-0-	-0-	-0-	-0-	-0-	7.7E+4	4.3E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.3E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-16

DOSE PARAMETER R_i FOR SECTOR G

Pathway = San Onofre State Beach Campground   Distance = 0.9 miles
X/Q = 6.6E-7 sec/m^3 D/Q = 3.3E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	8.0E+1	-0-	1.4E+2	-0-	1.6E+2	-0-	2.9E+2	-0-
Cr-51	1.6E+3	5.7E+5	2.1E+3	5.7E+5	2.6E+3	5.7E+5	3.3E+3	1.1E+6
Mn-54	1.2E+5	1.7E+8	1.9E+5	1.7E+8	2.4E+5	1.7E+8	3.2E+5	3.2E+8
Co-57	4.7E+4	4.2E+7	6.3E+4	4.2E+7	7.2E+4	4.2E+7	8.4E+4	7.8E+7
Co-58	9.6E+4	4.7E+7	1.4E+5	4.7E+7	1.7E+5	4.7E+7	2.1E+5	8.7E+7
Co-60	5.6E+5	2.7E+9	8.7E+5	2.7E+9	1.1E+6	2.7E+9	1.4E+6	4.9E+9
Sr-89	2.5E+5	2.7E+3	2.7E+5	2.7E+3	3.0E+5	2.7E+3	3.2E+5	4.9E+3
Sr-90	5.0E+6	-0-	1.2E+7	-0-	1.3E+7	-0-	2.3E+7	-0-
Zr-95	2.2E+5	3.1E+7	2.8E+5	3.1E+7	3.3E+5	3.1E+7	4.0E+5	5.7E+7
Nb-95	5.9E+4	1.7E+7	7.6E+4	1.7E+7	9.3E+4	1.7E+7	1.2E+5	3.1E+7
Ru-103	6.8E+4	1.3E+7	8.2E+4	1.3E+7	9.7E+4	1.3E+7	1.2E+5	2.5E+7
Te-129m	2.1E+5	2.4E+6	2.2E+5	2.4E+6	2.4E+5	2.4E+6	2.6E+5	4.5E+6
Cs-134	8.7E+4	8.4E+8	1.3E+5	8.4E+8	1.4E+5	8.4E+8	1.9E+5	1.6E+9
Cs-136	1.7E+4	1.9E+7	2.1E+4	1.9E+7	2.4E+4	1.9E+7	3.3E+4	3.4E+7
Cs-137	7.5E+4	1.3E+9	1.1E+5	1.3E+9	1.0E+5	1.3E+9	1.4E+5	2.3E+9
Ba-140	2.0E+5	2.5E+6	2.1E+5	2.5E+6	2.5E+5	2.5E+6	2.9E+5	4.7E+6
Ce-141	6.4E+4	1.7E+6	6.7E+4	1.7E+6	7.6E+4	1.7E+6	8.3E+4	3.1E+6
Ce-144	1.2E+6	8.6E+6	1.5E+6	8.6E+6	1.6E+6	8.6E+6	1.8E+6	1.6E+7
I -131	1.8E+6	2.1E+6	2.0E+6	2.1E+6	1.8E+6	2.1E+6	2.7E+6	3.9E+6
I -132	2.1E+4	1.5E+5	2.4E+4	1.5E+5	1.9E+4	1.5E+5	2.6E+4	2.8E+5
I -133	4.4E+5	3.0E+5	4.7E+5	3.0E+5	3.6E+5	3.0E+5	4.9E+5	5.6E+5
I -134	5.5E+3	5.5E+4	6.3E+3	5.5E+4	4.9E+3	5.5E+4	6.8E+3	1.0E+5
I -135	8.6E+4	3.1E+5	9.8E+4	3.1E+5	7.7E+4	3.1E+5	1.0E+5	5.8E+5
UN-ID	8.0E+4	9.2E+7	1.2E+5	9.2E+7	1.5E+5	9.2E+7	2.0E+5	1.7E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-17

SOUTH YARD FACILITY CONTROLLING LOCATION FACTORS

Radionuclide	$\Sigma_k R_{ik} W_k$ mrem/yr per μCi/sec	Use:	
H -3	1.31E-03	G:	SAN ONOFRE BCH CAMPGD
Cr-51	4.15E-02	F:	SO ST. PK./GUARD SHACK
Mn-54	9.70E+00	F:	SO ST. PK./GUARD SHACK
Co-57	2.41E+00	F:	SO ST. PK./GUARD SHACK
Co-58	3.14E+00	F:	SO ST. PK./GUARD SHACK
Co-60	1.35E+02	F:	SO ST. PK./GUARD SHACK
Sr-89	1.71E+00	F:	DEER CONSUMER/HUNTER
Sr-90	1.04E+02	G:	SAN ONOFRE BCH CAMPGD
Zr-95	7.26E+00	F:	DEER CONSUMER/HUNTER
Nb-95	2.88E+01	F:	DEER CONSUMER/HUNTER
Ru-103	4.56E+01	F:	DEER CONSUMER/HUNTER
Te-129m	2.26E+01	F:	DEER CONSUMER/HUNTER
Cs-134	4.28E+01	F:	SO ST. PK./GUARD SHACK
Cs-136	1.04E+00	F:	SO ST. PK./GUARD SHACK
Cs-137	6.36E+01	F:	SO ST. PK./GUARD SHACK
Ba-140	1.39E+00	G:	SAN ONOFRE BCH CAMPGD
Ce-141	4.29E-01	G:	SAN ONOFRE BCH CAMPGD
Ce-144	8.39E+00	G:	SAN ONOFRE BCH CAMPGD
I -131	2.28E+01	F:	DEER CONSUMER/HUNTER
I -132	1.22E-01	G:	SAN ONOFRE BCH CAMPGD
I -133	2.22E+00	G:	SAN ONOFRE BCH CAMPGD
I -134	3.24E-02	G:	SAN ONOFRE BCH CAMPGD
I -135	4.60E-01	G:	SAN ONOFRE BCH CAMPGD
UN-ID	5.36E+00	F:	SO ST PK./GUARD SHACK

Footnote: These values to be used in manual calculations are the maximum $\Sigma_k R_{ik} W_k$ for all locations based on the most restrictive age group.

TABLE 2-18

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR D

Pathway = Camp Horno Sewage Trmnt. Distance = 3.2 Miles
X/Q = 1.2E-7 sec/m^3 D/Q = 1.2E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+3	1.1E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+5	3.2E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	8.4E+4	7.8E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	2.1E+5	8.7E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	4.9E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+5	4.9E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	2.3E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	4.0E+5	5.7E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	3.1E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	2.5E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+5	4.5E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	1.9E+5	1.6E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+4	3.4E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+5	2.3E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+5	4.7E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	8.3E+4	3.1E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	1.6E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.7E+6	3.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+4	2.8E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	4.9E+5	5.6E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	6.8E+3	1.0E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+5	5.8E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	1.7E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-19

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR E

Pathway = Camp Horno   Distance = 3.7 Miles
X/Q = 6.0E-7 sec/m^3 D/Q = 5.7E-9 m^{-2}

Radio-Nuclide	Infant Inhalation Pathway	Infant Food & Ground Pathway	Child Inhalation Pathway	Child Food & Ground Pathway	Teen Inhalation Pathway	Teen Food & Ground Pathway	Adult Inhalation Pathway	Adult Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-20

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR F

Pathway = San Onofre State Park/Guard Shack   Distance = 0.4 Miles
X/Q = 5.4E-6 sec/m³   D/Q = 3.5E-8 m⁻²

Radio-Nuclide	Infant Inhalation Pathway	Infant Food & Ground Pathway	Child Inhalation Pathway	Child Food & Ground Pathway	Teen Inhalation Pathway	Teen Food & Ground Pathway	Adult Inhalation Pathway	Adult Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+3	8.0E+5
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	2.4E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	6.3E+4	5.9E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	1.6E+5	6.5E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+6	3.7E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	3.7E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	1.7E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+5	4.3E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	2.3E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	1.9E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	3.4E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.2E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+4	2.6E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.8E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+5	3.5E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+4	2.3E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	1.2E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+6	2.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+4	2.1E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	4.2E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	5.1E+3	7.7E+4
I -135	-0-	-0-	-0-	-0-	-0-	-0-	7.7E+4	4.3E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.3E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-20

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR F

Pathway = Border Patrol Checkpt. Distance = 1.4 Miles
X/Q = 1.2E-6 sec/m^3 D/Q = 8.2E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	4.1E+3	1.3E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	4.0E+5	3.9E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	9.8E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+5	1.1E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.7E+6	6.1E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	4.0E+5	6.2E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	2.8E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	7.2E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+5	3.9E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+5	3.1E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+5	5.6E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	1.9E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	4.2E+4	4.3E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+5	2.9E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	5.9E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+5	3.9E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	3.4E+6	4.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+4	3.5E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	6.1E+5	7.0E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+3	1.3E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+5	7.2E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+5	2.1E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-20

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR F

Pathway = Sheep (Meat)/Shepherd   Distance = 0.3 Miles
X/Q = 7.2E-6 sec/m^3 D/Q = 4.5E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	1.5E+0	-0-	1.2E+0	7.0E+0	2.1E+0
Cr-51	-0-	-0-	-0-	5.1E+1	-0-	1.0E+2	7.9E+1	2.6E+4
Mn-54	-0-	-0-	-0-	7.8E+2	-0-	1.4E+3	7.7E+3	7.6E+6
Co-57	-0-	-0-	-0-	4.7E+3	-0-	8.1E+3	2.0E+3	1.9E+6
Co-58	-0-	-0-	-0-	9.7E+3	-0-	2.0E+4	5.1E+3	2.1E+6
Co-60	-0-	-0-	-0-	3.7E+4	-0-	7.3E+4	3.3E+4	1.2E+8
Sr-89	-0-	-0-	-0-	5.0E+4	-0-	2.6E+4	7.7E+3	3.1E+4
Sr-90	-0-	-0-	-0-	1.0E+6	-0-	8.1E+5	5.5E+5	1.3E+6
Zr-95	-0-	-0-	-0-	6.3E+4	-0-	1.1E+5	9.7E+3	1.6E+6
Nb-95	-0-	-0-	-0-	2.4E+5	-0-	4.5E+5	2.8E+3	1.6E+6
Ru-103	-0-	-0-	-0-	4.2E+5	-0-	7.6E+5	2.8E+3	1.9E+6
Te-129m	-0-	-0-	-0-	6.0E+5	-0-	4.5E+5	6.4E+3	7.6E+5
Cs-134	-0-	-0-	-0-	1.4E+5	-0-	1.2E+5	4.7E+3	3.8E+7
Cs-136	-0-	-0-	-0-	5.1E+3	-0-	4.3E+3	8.1E+2	8.3E+5
Cs-137	-0-	-0-	-0-	1.3E+5	-0-	9.5E+4	3.4E+3	5.7E+7
Ba-140	-0-	-0-	-0-	5.1E+3	-0-	4.3E+3	7.0E+3	1.2E+5
Ce-141	-0-	-0-	-0-	1.5E+3	-0-	2.4E+3	2.0E+3	7.9E+4
Ce-144	-0-	-0-	-0-	1.8E+4	-0-	3.0E+4	4.3E+4	4.3E+5
I -131	-0-	-0-	-0-	6.6E+5	-0-	4.4E+5	6.6E+4	7.0E+5
I -132	-0-	-0-	-0-	-0-	-0-	-0-	6.3E+2	6.8E+3
I -133	-0-	-0-	-0-	1.6E+2	-0-	8.7E+3	1.2E+4	1.3E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	1.6E+2	2.5E+3
I -135	-0-	-0-	-0-	1.1E-18	-0-	6.4E-19	2.5E+3	1.4E+4
UN-ID	-0-	-0-	-0-	1.1E+5	-0-	9.5E+4	4.8E+3	4.2E+6

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-20

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR F

Page 4 of 4

Pathway = Deer Consumer/Hunter — Distance = 0.4 Miles

X/Q = 5.4E-6 sec/m^3 — D/Q = 3.5E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-21

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR G

Pathway = San Onofre Bch Campgd   Distance = 0.4 Miles
X/Q = 4.5E-6 sec/m³   D/Q = 1.8E-8 m⁻²

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	8.0E+1	-0-	1.4E+2	-0-	1.6E+2	-0-	2.9E+2	-0-
Cr-51	1.6E+3	5.7E+5	2.1E+3	5.7E+5	2.6E+3	5.7E+5	3.3E+3	1.1E+6
Mn-54	1.2E+5	1.7E+8	1.9E+5	1.7E+8	2.4E+5	1.7E+8	3.2E+5	3.2E+8
Co-57	4.7E+4	4.2E+7	6.3E+4	4.2E+7	7.2E+4	4.2E+7	8.4E+4	7.8E+7
Co-58	9.6E+4	4.7E+7	1.4E+5	4.7E+7	1.7E+5	4.7E+7	2.1E+5	8.7E+7
Co-60	5.6E+5	2.7E+9	8.7E+5	2.7E+9	1.1E+6	2.7E+9	1.4E+6	4.9E+9
Sr-89	2.5E+5	2.7E+3	2.7E+5	2.7E+3	3.0E+5	2.7E+3	3.2E+5	4.9E+3
Sr-90	5.0E+6	-0-	1.2E+7	-0-	1.3E+7	-0-	2.3E+7	-0-
Zr-95	2.2E+5	3.1E+7	2.8E+5	3.1E+7	3.3E+5	3.1E+7	4.0E+5	5.7E+7
Nb-95	5.9E+4	1.7E+7	7.6E+4	1.7E+7	9.3E+4	1.7E+7	1.2E+5	3.1E+7
Ru-103	6.8E+4	1.3E+7	8.2E+4	1.3E+7	9.7E+4	1.3E+7	1.2E+5	2.5E+7
Te-129m	2.1E+5	2.4E+6	2.2E+5	2.4E+6	2.4E+5	2.4E+6	2.6E+5	4.5E+6
Cs-134	8.7E+4	8.4E+8	1.3E+5	8.4E+8	1.4E+5	8.4E+8	1.9E+5	1.6E+9
Cs-136	1.7E+4	1.9E+7	2.1E+4	1.9E+7	2.4E+4	1.9E+7	3.3E+4	3.4E+7
Cs-137	7.5E+4	1.3E+9	1.1E+5	1.3E+9	1.0E+5	1.3E+9	1.4E+5	2.3E+9
Ba-140	2.0E+5	2.5E+6	2.1E+5	2.5E+6	2.5E+5	2.5E+6	2.9E+5	4.7E+6
Ce-141	6.4E+4	1.7E+6	6.7E+4	1.7E+6	7.6E+4	1.7E+6	8.3E+4	3.1E+6
Ce-144	1.2E+6	8.6E+6	1.5E+6	8.6E+6	1.6E+6	8.6E+6	1.8E+6	1.6E+7
I -131	1.8E+6	2.1E+6	2.0E+6	2.1E+6	1.8E+6	2.1E+6	2.7E+6	3.9E+6
I -132	2.1E+4	1.5E+5	2.4E+4	1.5E+5	1.9E+4	1.5E+5	2.6E+4	2.8E+5
I -133	4.4E+5	3.0E+5	4.7E+5	3.0E+5	3.6E+5	3.0E+5	4.9E+5	5.6E+5
I -134	5.5E+3	5.5E+4	6.3E+3	5.5E+4	4.9E+3	5.5E+4	6.8E+3	1.0E+5
I -135	8.6E+4	3.1E+5	9.8E+4	3.1E+5	7.7E+4	3.1E+5	1.0E+5	5.8E+5
UN-ID	8.0E+4	9.2E+7	1.2E+5	9.2E+7	1.5E+5	9.2E+7	2.0E+5	1.7E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-21

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR G

Pathway = Highway Patrol Weigh Station Distance = 1.6 Miles
X/Q = 4.2E-7 sec/m^3 D/Q = 1.7E-9 m^{-2}

	Infant		Child		Teen		Adult	
Radio-Nuclide	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	3.4E+3	1.1E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+5	3.3E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	8.8E+4	8.1E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+5	9.0E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	5.1E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+5	5.1E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	4.2E+5	6.0E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	3.2E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	2.6E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.8E+5	4.7E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	1.6E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	3.5E+4	3.6E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	2.4E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+5	4.9E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	3.2E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	1.7E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.8E+6	4.1E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.7E+4	2.9E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	5.1E+5	5.8E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	7.1E+3	1.1E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	6.0E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	2.1E+5	1.8E+8

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-21

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR G

Pathway = Sheep (Meat)/Shepherd   Distance = 2.3 Miles
X/Q = 2.4E-7 sec/m³   D/Q = 9.2E-10 m⁻²

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	1.5E+0	-0-	1.2E+0	7.0E+0	2.1E+0
Cr-51	-0-	-0-	-0-	5.1E+1	-0-	1.0E+2	7.9E+1	2.6E+4
Mn-54	-0-	-0-	-0-	7.8E+2	-0-	1.4E+3	7.7E+3	7.6E+6
Co-57	-0-	-0-	-0-	4.7E+3	-0-	8.1E+3	2.0E+3	1.9E+6
Co-58	-0-	-0-	-0-	9.7E+3	-0-	2.0E+4	5.1E+3	2.1E+6
Co-60	-0-	-0-	-0-	3.7E+4	-0-	7.3E+4	3.3E+4	1.2E+8
Sr-89	-0-	-0-	-0-	5.0E+4	-0-	2.6E+4	7.7E+3	3.1E+4
Sr-90	-0-	-0-	-0-	1.0E+6	-0-	8.1E+5	5.5E+5	1.3E+6
Zr-95	-0-	-0-	-0-	6.3E+4	-0-	1.1E+5	9.7E+3	1.6E+6
Nb-95	-0-	-0-	-0-	2.4E+5	-0-	4.5E+5	2.8E+3	1.6E+6
Ru-103	-0-	-0-	-0-	4.2E+5	-0-	7.6E+5	2.8E+3	1.9E+6
Te-129m	-0-	-0-	-0-	6.0E+5	-0-	4.5E+5	6.4E+3	7.6E+5
Cs-134	-0-	-0-	-0-	1.4E+5	-0-	1.2E+5	4.7E+3	3.8E+7
Cs-136	-0-	-0-	-0-	5.1E+3	-0-	4.3E+3	8.1E+2	8.3E+5
Cs-137	-0-	-0-	-0-	1.3E+5	-0-	9.5E+4	3.4E+3	5.7E+7
Ba-140	-0-	-0-	-0-	5.1E+3	-0-	4.3E+3	7.0E+3	1.2E+5
Ce-141	-0-	-0-	-0-	1.5E+3	-0-	2.4E+3	2.0E+3	7.9E+4
Ce-144	-0-	-0-	-0-	1.8E+4	-0-	3.0E+4	4.3E+4	4.3E+5
I -131	-0-	-0-	-0-	6.6E+5	-0-	4.4E+5	6.6E+4	7.0E+5
I -132	-0-	-0-	-0-	-0-	-0-	-0-	6.3E+2	6.8E+3
I -133	-0-	-0-	-0-	1.6E+2	-0-	8.7E+3	1.2E+4	1.3E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	1.6E+2	2.5E+3
I -135	-0-	-0-	-0-	1.1E-18	-0-	6.4E-19	2.5E+3	1.4E+4
UN-ID	-0-	-0-	-0-	1.1E+5	-0-	9.5E+4	4.8E+3	4.2E+6

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-21

SOUTH YARD FACILITY DOSE PARAMETER R_i FOR SECTOR G

Pathway = Deer Consumer/Hunter; Distance = 2.9 Miles
X/Q = 1.8E-7 sec/m^3; D/Q = 6.4E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

3.0 PROJECTED DOSES

3.1 Liquid Dose Projection

The methodology used for projecting a liquid dose over 31 days for Specification 1.3.1 is as follows:

1. Determine the monthly total body and organ doses resulting from releases during the previous twelve months.

2. Projected dose = Previous 12 months' dose divided by 12 for the total body and each organ.

3.2 Gaseous Dose Projection

The methodology used for projecting a gaseous dose over 31 days for Specification 2.4.1 is as follows:

1. Determine the monthly gamma, beta and organ dose resulting from releases during the previous twelve months.

2. Projected dose = Previous 12 months' dose divided by 12 for the gamma, beta and organ doses.

3.0 **PROJECTED DOSES** (Continued)

3.3 TOTAL DOSE

SPECIFICATION

3.3.1 The dose or dose commitment to any member of the public, due to releases of radioactivity and radiation, from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which shall be limited to less than or equal to 75 mrem) over 12 consecutive months.

APPLICABILITY: At all times

ACTION:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Specifications 1.2.1.a, 1.2.1.b, 2.2.1.a, 2.2.1.b, 2.3.1.a, or 2.3.1.b in lieu of any other report required by Specification 6.9.1, prepare and submit a Special Report to the Director, Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, within 30 days, which defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the limits of Specification 3.3.1. This Special Report shall include an analysis which estimates the radiation exposure (dose) to a member of the public from uranium fuel cycle sources (including all effluent pathways and direct radiation) for a 12 consecutive month period that includes the release(s) covered by this report. If the estimated dose(s) exceeds the limits of Specification 3.3.1, and if the release condition resulting in violation of 40 CFR 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190 and including the specified information of paragraph 190.11(b). Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete. The variance only relates to the limits of 40 CFR 190, and does not apply in any way to the requirements for dose limitation of 10 CFR Part 20, as addressed elsewhere in this ODCM.

SURVEILLANCE REQUIREMENTS

.1 Dose Calculations Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with surveillance 1.2.1.1, 2.2.1.1, and 2.3.1.1.

3.0 **PROJECTED DOSES** (Continued)

3.4 TOTAL DOSE CALCULATIONS

3.4.1 Total Dose to Most Likely Member of the Public

The total annual dose or total dose commitment to any member of the public, due to releases of radioactivity and to radiation, from uranium fuel cycle sources within 5 miles of the Site is calculated using the following expressions. This methodology is used to meet the dose limitations of 40 CFR 190 per twelve consecutive months. The transportation of radioactive material is excluded from the dose calculations.

The Annual Total Dose is determined monthly for maximum organ (gas & liquid), whole body (gas & liquid) and thyroid (gas & liquid) to verify that the Site total (Units 1, 2 and 3) is less than or equal to 25 mrem, 25 mrem, and 75 mrem respectively.

.1 Annual Total Organ Dose (D_{TOT} (O))

$$D_{TOT}(O) = \sum_{l=1}^{12} \sum_{j=1}^{2/3} \left[D_{jl}(OG) + D_{jl}(OL) + D_{jl}^{H^3*}(OG) \right] \qquad (3\text{-}1)$$

where:

*NOTE: $D_{jl}^{H^3}(OG)$ = 0 for bone

**All to be summed over the most recent 12 months.

$$D_{jl}(OG) = K \sum_{i=1}^{n} C_i \sum_k R_{ik} W_k \qquad (3\text{-}2)$$

i = each isotope in specific organ category

j = Units 1, 2 and 3

l = months 1 - 12**

$$K = 3.1688E\text{-}2 \ \frac{\text{year-}\mu\text{Ci}}{\text{sec-Ci}}$$

3.0 **PROJECTED DOSES** (Continued)

3.4 **TOTAL DOSE CALCULATIONS** (Continued)

3.4.1 **Total Dose to Most Likely Member of the Public** (Continued)

n = number of isotopes in the specified organ category

C_i = total particulate gas curies released for the month

$\sum_k r_{ik}W_k$ = controlling location factors from ODCM Table 2-5, Unit 1 and Table 2-6, Units 2/3, for all pathways k.

$D_{jl}(OL)$ = liquid organ dose for the specified organ in mrem for the month. [Reference ODCM Units 2/3 (1-19), Unit 1 (1-13)]

$D_{jl}^{H^3}(OG)$ *= gas organ dose form tritium in mrem for the month. [Reference ODCM Unit 1 (2-14), ODCM Units 2/3 (2-18)]

.2 Annual Total Whole Body Dose $D_{TOT}(WB)$

$$D_{TOT}(WB) = \sum_{l=1}^{12} \sum_{j=1}^{2/3} \left[D_{jl}(WBL) + D_{jl}^{H^3}(OG) + 0.9\, D_{jl}(\gamma) \right] + D(DIRECT) \qquad \textbf{(3-3)}$$

where:

j = Units 1, 2 and 3

l = months 1 - 12, to be summed over the most recent 12 months

$D_{jl}(WBL)$ = liquid whole body organ dose in mrem for the whole month. [Reference ODCM Units 2/3 (1-19), ODCM Unit 1 (1-13)]

$D_{jl}^{H^3}(OG)$ = gas organ dose from tritium in mrem for the month. [Refer ODCM Units 2/3 (2-18), ODCM Unit 1 (2-14)]

$D_{jl}(\gamma)$ = gamma air dose in mrad for the month. 0.9 converts mrad to mrem. [Reference ODCM Units 2/3 (2-14), ODCM Unit 1 (2-10)]

$$D\ (Direct) = \sum_{q=1}^{4} \left[\max[D(beach)_i] - \frac{\sum_{p=1}^{n} D(bkgd)_i}{n} \right] .0342 \qquad \textbf{(3-4)}$$

p = for all TLDs per quarter

q = for Quarters 1-4

3.0 PROJECTED DOSES (Continued)

3.4 TOTAL DOSE CALCULATIONS (Continued)

3.4.1 Annual Total Whole Body Dose D_{TOT}(WB) (Continued)

*Direct Radiation

The direct radiation levels are evaluated most recently using thulium doped TLDs. The TLDs are placed at a minimum of 30 locations around the site. The average dose measured by TLDs 5 to 50 miles from the site is used as background. These sites are subject to change.

The background is subtracted from the highest reading TLD within 5 miles of the site (generally numbers 55 through 58). This value is the direct dose but must be prorated by the occupancy factor.

Example: Beach time (west boundary, seawall) of 300 hrs/yr, east and north boundaries of 20 hrs/yr, or 8 hrs/yr for the south boundary and west fence of parking lot 1 (top of bluff).

Reference: E. M. Goldin Memorandum for File, "Occupancy Factors at San Onofre Owner Controlled Area Boundaries," dated October 1, 1991.

.3 Annual Total Thyroid Dose D_{TOT} (T)

$$D_{TOT}(T) = \sum_{l=1}^{12} \sum_{j=1}^{2/3} \left[D_{jl}\,(OG) + D_{jl}\,(OL)\right] \qquad (3\text{-}5)$$

where:

j = Units 1, 2 and 3

l = months 1 - 12, to be summed over the most recent 12 months

D_{jl} (OG) = thyroid organ dose from gaseous iodine for the month in mrem. (from 2-21)

D_{jl} (OL) = liquid thyroid organ dose for the month in mrem. [Reference ODCM Units 2/3 (1-19), Unit 1 ODCM (1-13)]

4.0 EQUIPMENT

4.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

SPECIFICATION

4.1.1 The radioactive liquid effluent monitoring instrumentation channels shown in Table 4-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 1.1.1 are not exceeded. The alarm/trip setpoints of these channels shall be determined in accordance with Section 1.4.

APPLICABILITY: At all times

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately suspend the release of radioactive liquid effluents monitored by the affected channel or declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 4-1. Exert best efforts to return the instrument to OPERABLE status within 30 days and, additionally, if the inoperable instrument(s) remain inoperable for greater than 30 days, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE and either the appropriate ACTION items in Table 4-1 not taken or the necessary surveillances not performed at the specified frequency prescribed in Table 4-2, perform an evaluation based on the significance of the event in accordance with the site Corrective Action Program.

SURVEILLANCE REQUIREMENTS

.1 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 4-2.

.2 At least once per 12 hours and within 1 hour after a change in pump operation that affects dilution flow has been completed, all pumps required to be providing dilution to meet the site radioactive effluent concentration limits of Specification 1.1.1 shall be determined to be operating and providing dilution to the discharge structure.

TABLE 4-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

	INSTRUMENT*	MINIMUM CHANNELS OPERABLE	ACTION
1.	GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE		
	a. Liquid Radwaste Effluent Line - 2/3RT-7813	1	28
	b. Steam Generator Blowdown Processing System (Neutralization Sump) Full Flow Condensate Polisher Effluent Line - 2(3)RT-7817	1	29
	c. Turbine Plant Sumps, Auxiliary Building Sump Component Cooling Water Sumps, Storage Tank Area Sumps Effluent Line - 2(3)RT-7821	1	30
	d. Steam Generator (E088) Blowdown Effluent Line - 2(3)RT-6759	1	29
	e. Steam Generator (E089) Blowdown Effluent Line - 2(3)RT-6753	1	29
2.	PROCESS FLOW RATE MEASUREMENT DEVICES		
	a. Liquid Radwaste Effluent Line	1	31
	b. Steam Generator Blowdown Processing System (Neutralization Sump), Full Flow Condensate Polisher Effluent Line	1	31
	c. Turbine Plant Sumps, Auxiliary Building Sump Component Cooling Water Sumps, Storage Tank Area Sumps Effluent Line	1	31
	d. Steam Generator (E088) Blowdown Bypass Effluent Line	1	31
	e. Steam Generator (E089) Blowdown Bypass Effluent Line	1	31
3.	DATA ACQUISITION SYSTEM (CONTROL ROOM ALARM ANNUNCIATION)	1	32

TABLE 4-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT*		MINIMUM CHANNELS OPERABLE	ACTION
4.	CONTINUOUS COMPOSITE SAMPLERS		
	a. Turbine Plant Sump, Auxiliary Building Sumps - 2(3) APC 5887	1	33
	b. Blowdown Processing System Neutralization Sump - 2(3) APC 3772	1	33
	c. Steam Generator (E088) Blowdown to Bypass, Steam Generator (E088) Blowdown - 2(3) APC 4077	1	33
	d. Steam Generator (E089) Blowdown to Bypass, Steam Generator (E089) Blowdown - 2(3) APC 4076	1	33

TABLE 4-1 (Continued)

TABLE NOTATION

* Monitor Recorders are not required for the Operability of the monitor, providing the inoperable recorder does not cause the monitor to become inoperable (i.e., feedback signal). As long as the monitor has indication, alarm capability (if applicable), proper response (based on surveillance requirements) and isolation function (if applicable), the loss of the recorder does not render the monitor inoperable.

ACTION 28 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirements, effluent releases may continue provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with Specification 1.1.1 and

b. At least two technically qualified members of the Facility Staff independently verify the release rate calculation and discharge line valving;

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 29 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least 10^{-7} microcuries/gram:

a. At least once per 8 hours when the specific activity of the secondary coolant is greater than 0.01 microcuries/gram DOSE EQUIVALENT I-131;

b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microcuries/gram DOSE EQUIVALENT I-131; or

c. Lock closed valve S2(3)1318MU577 and divert flow to T-064 for processing as liquid radwaste.

ACTION 30 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that, at least once per 12 hours, grab samples are collected and analyzed within 4 hours of collection time for gross radioactivity (beta or gamma) at a limit of detection of at least 10^{-7} microcuries/ml or lock closed valve S2(3)2419MU077 or S2(3)2419MU078 and divert flow to the radwaste sump for processing as liquid radwaste.

TABLE 4-1 (Continued)

TABLE NOTATION

ACTION 31 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the process flow rate is estimated at least once per 12 hours during actual releases. In addition, a new flow estimate shall be made within 1 hour after a change that affects process flow has been completed. Pump curves may be used to estimate process flow.

Loss of process flow instrument(s) results in the associated gross activity monitor becoming INOPERABLE. Perform the compensatory action for the inoperable gross activity monitor in addition to this compensatory action. [2(3)RT-7817, 2(3)RT-7821, 2/3RT-7813]

ACTION 32 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the monitor is verified OPERABLE by performing a channel check at least once per 4 hours during actual releases.

ACTION 33 - With the number of channels OPERABLE less than required by Minimum channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are collected daily, and composited and analyzed weekly:

a. at least once per 24 hours, not to exceed 30 hours

b. at least once per 12 hours for steam generator when the specific activity of the secondary coolant is greater than 0.01 microcuries/gram DOSE EQUIVALENT I-131.

TABLE 4-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT**	CHANNEL CHECK	SOURCE CHECK	CHANNELS CALIBRATION	CHANNEL FUNCTIONAL TEST
1. GROSS BETA OR GAMMA RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE				
a. Liquid Radwaste Effluents Line - 2/3RT-7813	D	P	R(2)	Q(1)
b. Steam Generator Blowdown Processing System (Neutralization Sump), Full Flow Condensate Polisher Effluent Line - 2(3)RT-7817	D	M	R(2)	Q(1)
c. Turbine Plant Sump, Auxiliary Building Sump, Component Cooling Water Sumps, Storage Tank Area Sumps Effluent Line - 2(3)RT-7821	D	M	R(2)	Q(1)
d. Steam Generator (E088) Blowdown Bypass Effluent Line - 2(3)RT-6759	D	M	R(2)	Q(1)
e. Steam Generator (E089) Blowdown Bypass Effluent Line - 2(3)RT-6753	D	M	R(2)	Q(1)
2. PROCESS FLOW RATE MEASUREMENT DEVICES				
a. Liquid Radwaste Effluent Line	D(3)	NA	R	Q
b. Steam Generator Blowdown Processing System (Neutralization Sump), Full Flow Condensate Polisher Effluent Line	D(3)	NA	R	Q
c. Turbine Plant Sump, Auxiliary Building Sump, Component Cooling Water Sumps, Storage Tank Area Sumps Effluent Line	D(3)	NA	R	Q
d. Steam Generator (E088) Blowdown Bypass Effluent Line	D(3)	NA	R	Q
e. Steam Generator (E089) Blowdown Bypass Effluent Line	D(3)	NA	R	Q
3. DATA ACQUISITION SYSTEM (CONTROL ROOM ALARM ANNUNCIATION)	D	NA	NA(4)	Q

TABLE 4-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT**	CHANNEL CHECK	SOURCE CHECK	CHANNELS CALIBRATION	CHANNEL FUNCTIONAL TEST
4. CONTINUOUS COMPOSITE SAMPLERS				
a. Turbine Plant Sump, Auxiliary building Sumps - 2(3) APC 5887	D(5)	N/A	R	Q
b. Blowdown Processing System Neutralization Sump - 2(3) APC 3772	D(5)	N/A	R	Q
c. Steam Generator (E088) Blowdown to Bypass, Steam Generator (E088) Blowdown - 2(3) APC 4077	D(5)	N/A	R	Q
d. Steam Generator (E089) Blowdown to Bypass, Steam Generator (E089) Blowdown - 2(3) APC 4076	D(5)	N/A	R	Q

TABLE 4-2 (Continued)

TABLE NOTATION

** Monitor Recorders are not required for the Operability of the monitor, providing the inoperable recorder does not cause the monitor to become inoperable (i.e., feedback signal). As long as the monitor has indication, alarm capability (if applicable), proper response (based on surveillance requirements) and isolation function (if applicable), the loss of the recorder does not render the monitor inoperable.

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate verification of effluent path isolation actuation signal, automatic pathway isolation†, and Control Room alarm annunciation if any of the following conditions exist:

1. Instrument indicates measured levels above the alarm/trip setpoint.
2. Circuit failure.

† Automatic pathway isolation is tested on a once per refueling period.

Down scale failure testing is bounded by administrative limitation on monitor setpoint which ensure monitor alarm and release termination occur prior to reaching the level of monitor saturation.

If the instrument controls are not in the operate mode, procedures shall require that the channel be declared inoperable.

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATIONs, sources that have been related to the initial calibration shall be used.

(3) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

(4) The Data Acquisition System (DAS) software and hardware do not require Channel Calibration. The DAS software is quality affecting and controlled by the site Software Modification Request process under procedure SO123-V-4.71, Software Development and Maintenance. The DAS hardware is installed plant equipment and controlled by the site design change process utilizing procedure SO123-XXIX-2.10, Design Change Process or SO123-XXIV-10.21, Field Change Notice (FCN) and Field Interim Design Change Notice (FIDCN).

(5) CHANNEL CHECK shall consist of verifying compositor switch positions and installed counter setting, and comparing integrator readings to sample volume collected.

4.0 EQUIPMENT

4.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

SPECIFICATION

4.2.1 The radioactive gaseous effluent monitoring instrumentation channels shown in Table 4-3 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 2.1.1 are not exceeded. The alarm/trip setpoints of these channels shall be determined in accordance with ODCM.

APPLICABILITY: At all times

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel or declare the channel inoperable.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 4-3. Exert best efforts to return the instrument to OPERABLE status within 30 days and, additionally, if the inoperable instrument(s) remain inoperable for greater than 30 days, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE and either the appropriate ACTION items in Table 4-3 not taken or the necessary surveillances not performed at the specified frequency prescribed in Table 4-4, perform an evaluation based on the significance of the event in accordance with the site Corrective Action Program.

SURVEILLANCE REQUIREMENTS

.1 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 4-4.

TABLE 4-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT***	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. WASTE GAS HOLDUP SYSTEM			
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release - 2/3RT-7808, or 3RT-7865-1	1	*	35
b. Process Flow Rate Monitoring Device	1	*	36
2. CONDENSER EVACUATION SYSTEM			
a. Noble Gas Activity Monitor - 2(3)RT-7818, or 2(3)RT-7870-1	1	**	37
b. Iodine Sampler	1	**	40
c. Particulate Sampler	1	**	40
d. Associated P&I Sample Flow Measuring Device	1	**	36
e. Process Flow Rate Monitoring Device	1(1)	**	36
3. PLANT VENT STACK			
a. Noble Gas Activity Monitor - 2/3RT-7808, or 2RT-7865-1 and 3RT-7865-1	1(3)	*	37
b. Iodine Sampler	1(3)	*	40
c. Particulate Sampler	1(3)	*	40
d. Associated P&I Sample Flow Measuring Device	1(3)	*	36
e. Process Flow Rate Monitoring Device - 2/3RT-7808, or 2RT-7865-1 and 3RT-7865-1	1	*	36
4. CONTAINMENT PURGE SYSTEM			
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release - 2(3)RT-7828, or 2(3)RT-7865-1	1	*	38
b. Iodine Sampler	1	*	40
c. Particulate Sampler	1	*	40
d. Associated P&I Sample Flow Measuring Device	1	*	36
e. Process Flow Rate Monitoring Device	1	*	36
5. DATA ACQUISITION SYSTEM (CONTROL ROOM ALARM ANNUNCIATION)	1	*	42

TABLE 4-3 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

	INSTRUMENT***	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
6.	SOUTH YARD FACILITY (SYF) WORK AREA			
	a. Particulate Activity Monitor - SYFRT-7904	1	*	40
	b. Iodine Sampler	1	*	40
	c. Particulate Sampler	1	*	40
	d. Associated P&I Sample Flow Measuring Device	1	*	41
	e. Process Flow Rate Monitoring Device	1	*	41
7.	SOUTH YARD FACILITY (SYF) DECONTAMINATION UNIT			
	a. Particulate Activity Monitor - SYFRT-7905	1	*	40
	b. Iodine Sampler	1	*	40
	c. Particulate Sampler	1	*	40
	d. Associated P&I Sample Flow Measuring Device	1	*	41
	e. Process Flow Rate Monitoring Device	1	*	41
8.	SOUTH YARD FACILITY DATA ACQUISITION SYSTEM OR DATALINK TO MAIN DAS	1	*	43

TABLE 4-3 (Continued)

TABLE NOTATION

* At all times.

** MODES 1-4 with any main steam isolation valve and/or any main steam isolating bypass valve not fully closed.

*** Monitor Recorders are not required for the Operability of the monitor, providing the inoperable recorder does not cause the monitor to become inoperable (i.e., feedback signal). As long as the monitor has indication, alarm capability (if applicable), proper response (based on surveillance requirements) and isolation function (if applicable), the loss of the recorder does not render the monitor inoperable.

(1) 2(3)RT-7818 is not equipped to monitor process flow. If another means of continuously monitoring process flow is not available, then comply with ACTION 36.

(2) Deleted.

(3) Due to unequal mixing in the Plant Vent Stack, both 2RT-7865-1 and 3RT-7865-1 are required to be operable when 2/3RT-7808 is inoperable.

ACTION 35 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment provided that prior to initiating the release:

a. At least two independent samples of the tank's contents are analyzed, and

b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge valve lineup;

Otherwise, suspend releases of radioactive effluents via this pathway.

TABLE 4-3 (Continued)

TABLE NOTATION

ACTION 36 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided:

a. The process flow rate is estimated at least once per 12 hours during actual releases. In addition, a new flow estimate shall be made within 1 hour after a change that affects process flow has been completed. System design characteristics may be used to estimate process flow.

b. The particulate and iodine (P&I) sample flow rate is estimated or verified at least once per 12 hours during actual releases.

ACTION 37 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 38 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, immediately suspend PURGING of radioactive effluents via this pathway.

ACTION 40 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the effected pathway may continue provided samples are continuously collected with auxiliary sampling equipment as required in Table 2-1.

ACTION 41 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided:

a. The process flow rate is estimated at least once per 12 hours during times of building occupation. System design characteristics may be used to estimate flow.

b. The particulate and iodine (P&I) sample flow rate is estimated at least once per 12 hours during times of building occupation.

ACTION 42 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the monitor is verified operable by performing a channel check at least once per 4 hours during actual releases.

ACTION 43 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the monitor is verified OPERABLE by performing a channel check at least once per 12 hours during times of building occupation.

TABLE 4-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT***	CHANNEL CHECK	SOURCE CHECK	CHANNELS CALIBRATION	CHANNEL FUNCTIONAL TEST	MODE FOR WHICH SURVEILLANCE IS REQUIRED
1. WASTE GAS HOLDUP SYSTEM					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release - 2/3RT-7808, 3RT-7865-1	P	P	R(3)	Q(1)	*
b. Process Flow Rate Monitoring Device	P	NA	R	Q	*
2. CONDENSER EVACUATION SYSTEM					
a. Noble Gas Activity Monitor - 2(3)RT-7818, 2(3)RT-7870-1	D	M	R(3)	Q(2)	**
b. Iodine Sampler	W	NA	NA	NA	**
c. Particulate Sampler	W	NA	NA	NA	**
d. Associated Sample Flow Measuring Device	D	NA	R	Q	**
e. Process Flow Rate Monitoring Device (2(3)RT-7870-1)	D	NA	R	Q	**

TABLE 4-4 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT***	CHANNEL CHECK	SOURCE CHECK	CHANNELS CALIBRATION	CHANNEL FUNCTIONAL TEST	MODE FOR WHICH SURVEILLANCE IS REQUIRED
3. PLANT VENT STACK					
a. Noble Gas Activity Monitor - 2/3RT-7808, 2RT-7865-1, 3RT-7865-1	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Associated Sample Flow Measuring Device	D	NA	R	Q	*
e. Process Flow Rate Monitoring Device	D	NA	R	Q	*
4. CONTAINMENT PURGE SYSTEM					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release - 2(3)RT-7828, 2(3)RT-7865-1	D	P(4)	R(3)	Q(1)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Process Flow Rate Monitoring Device	D	NA	R	Q	*
e. Associated Sample Flow Measuring Device	D	NA	R	Q	*
5. DATA ACQUISITION SYSTEM (CONTROL ROOM ALARM ANNUNCIATION)	D	NA	NA(8)	Q	*

TABLE 4-4 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT***	CHANNEL CHECK	SOURCE CHECK	CHANNELS CALIBRATION	CHANNEL FUNCTIONAL TEST	MODE FOR WHICH SURVEILLANCE IS REQUIRED
6. SOUTH YARD FACILITY (SYF) WORK AREA					
a. Particulate Activity Monitor - SYFRT-7904	D	M	R(3)	Q(7)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Process Flow Rate Monitoring Device	D(5)	NA	R	Q	*
e. Associated Sample Flow Measuring Device	D(5)	NA	R	Q	*
7. SOUTH YARD FACILITY (SYF) DECONTAMINATION UNIT					
a. Particulate Activity Monitor - SYFRT-7905	D	M	R(3)	Q(7)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Process Flow Rate Monitoring Device	D(6)	NA	R	Q	*
e. Associated Sample Flow Measuring Device	D(6)	NA	R	Q	*
8. SOUTH YARD FACILITY ACQUISITION SYSTEM OR DATA LINK TO MAIN DAS	D	NA	NA(8)	Q	*

NOTE: For 6 and 7, surveillance requirements to take effect upon DCP A-7022.00SC turnover of these instruments.

TABLE 4-4 (Continued)

TABLE NOTATION

* At all times.

** Modes 1-4 with any main steam isolation valve and/or any main steam isolating bypass valve not fully closed.

*** Monitor Recorders are not required for the Operability of the monitor, providing the inoperable recorder does not cause the monitor to become inoperable (i.e., feedback signal). As long as the monitor has indication, alarm capability (if applicable), proper response (based on surveillance requirements) and isolation function (if applicable), the loss of the recorder does not render the monitor inoperable.

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate verification of effluent path isolation actuation signal, automatic pathway isolation†, and Control Room alarm annunciation if any of the following conditions exist:

1. Instrument indicates measured levels above the alarm/trip setpoint.
2. Circuit failure.

† Automatic pathway isolation is tested on a once per refueling interval.

† The main containment purge isolation valves are required to be tested in Mode 5 prior to performing initial core alterations. Containment purge valves are not required to be tested for automatic isolation in the event of a mid-cycle outage.

Down scale failure testing is bounded by administrative limitation on monitor setpoints which ensure monitor alarm and release termination occur prior to reaching the level of monitor saturation.

If the instrument controls are not set in the operate mode, procedures shall call for declaring the channel inoperable.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:#

1. Instrument indicates measured levels above the alarm setpoint.
2. Circuit failure.

Down scale failure testing is bounded by administrative limitation on monitor setpoints which ensure monitor alarm and release termination occur prior to reaching the level of monitor saturation.

If the instrument controls are not set in the operate mode, procedures shall call for declaring the channel inoperable.

TABLE 4-4 (Continued)

TABLE NOTATION (Continued)

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATIONs, sources that have been related to the initial calibration shall be used.

(4) Prior to each release and at least once per month.

(5) Daily checks only required during times of building occupation.

(6) CHANNEL CHECK required by Health Physics daily for each day that the CO_2 Decontamination Unit is used.

(7) The CHANNEL FUNCTIONAL TEST shall also demonstrate verification of effluent path isolation actuation signal, if any of the following conditions exist:

1. Instrument indicates measured levels above the alarm/trip setpoint.
2. Circuit failure.

Automatic pathway isolation is tested on a once per 24 month interval.

Down scale failure testing is bounded by administrative limitation on monitor setpoints which ensure monitor alarm and release termination occur prior to reaching the level of monitor saturation.

(8) The Data Acquisition System (DAS) software and hardware do not require Channel Calibration. The DAS software is quality affecting and controlled by the site Software Modification Request process under procedure SO123-V-4.71, Software Development and Maintenance. The DAS hardware is installed plant equipment and controlled by the site design change process utilizing procedure SO123-XXIX-2.10, Design Change Process or SO123-XXIV-10.21, Field Change Notice (FCN) and Field Interim Design Change Notice (FIDCN).

4.3 OPERABILITY OF RADIOACTIVE WASTE EQUIPMENT

The flow diagrams defining the treatment paths and the components of the radioactive liquid, gaseous and solid waste management systems are shown in Figures 4-5 thru 4-7.

FIGURE 4-5 SONGS 2 & 3 RADIOACTIVE LIQUID WASTE TREATMENT SYSTEMS

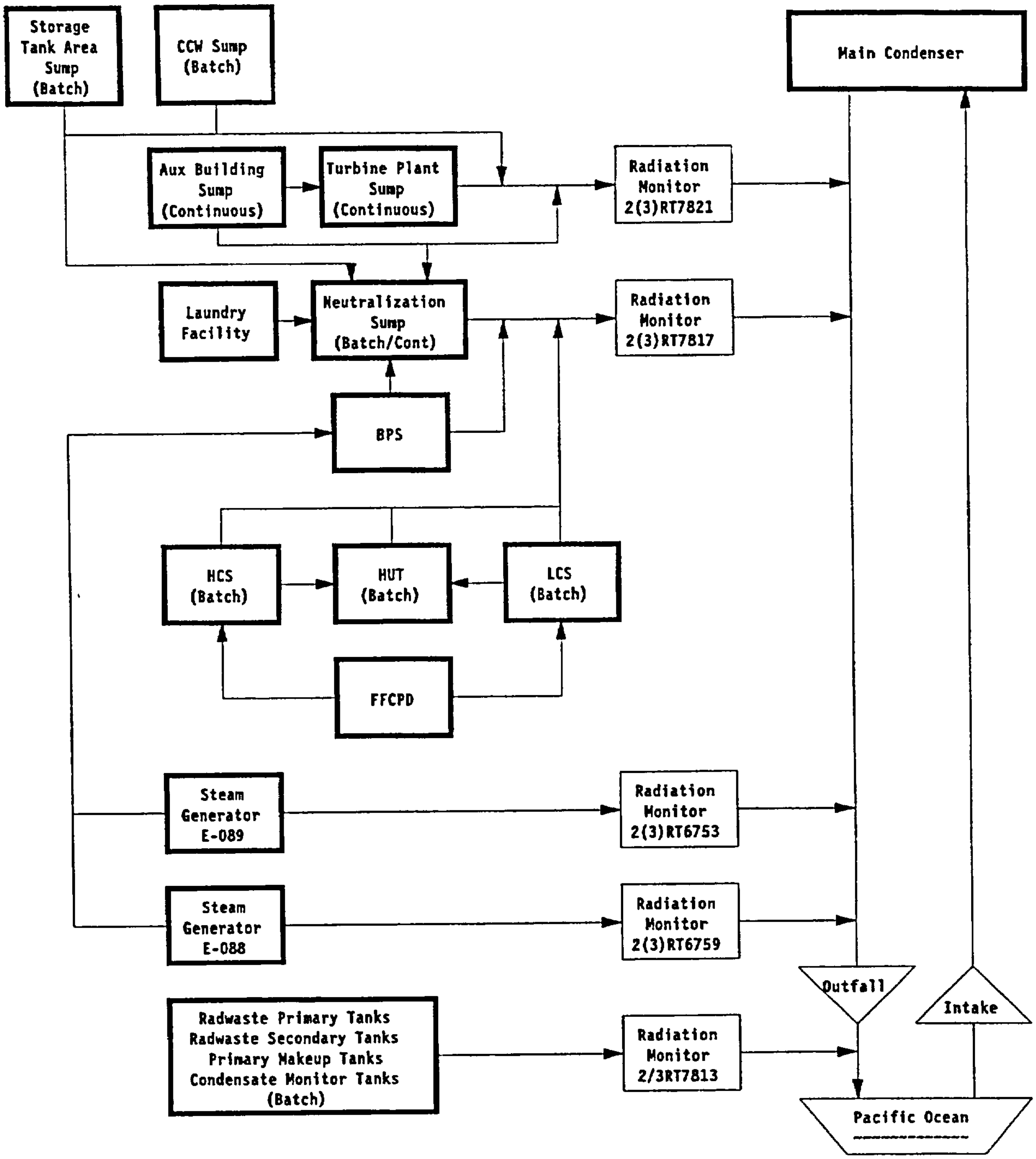
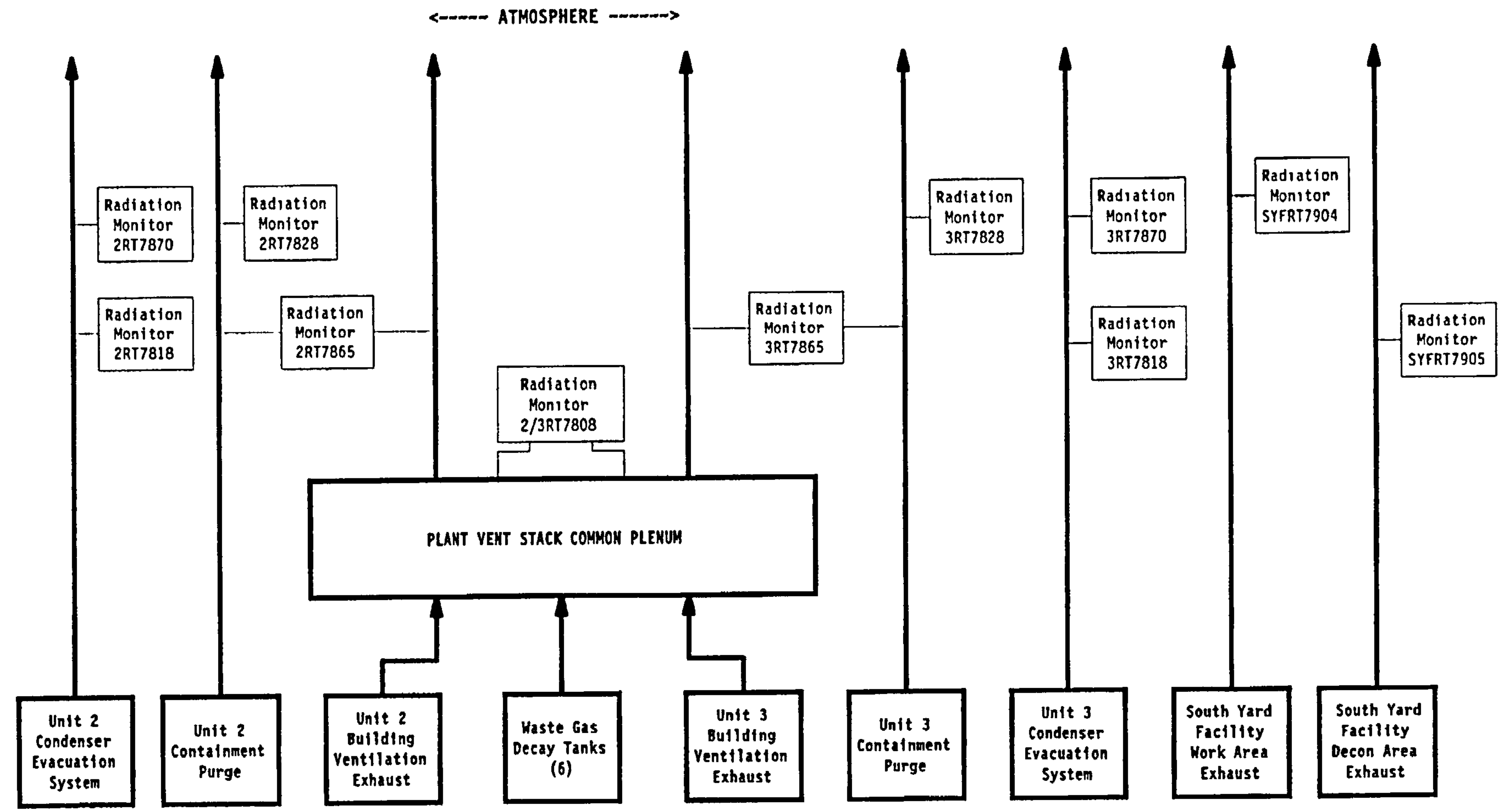
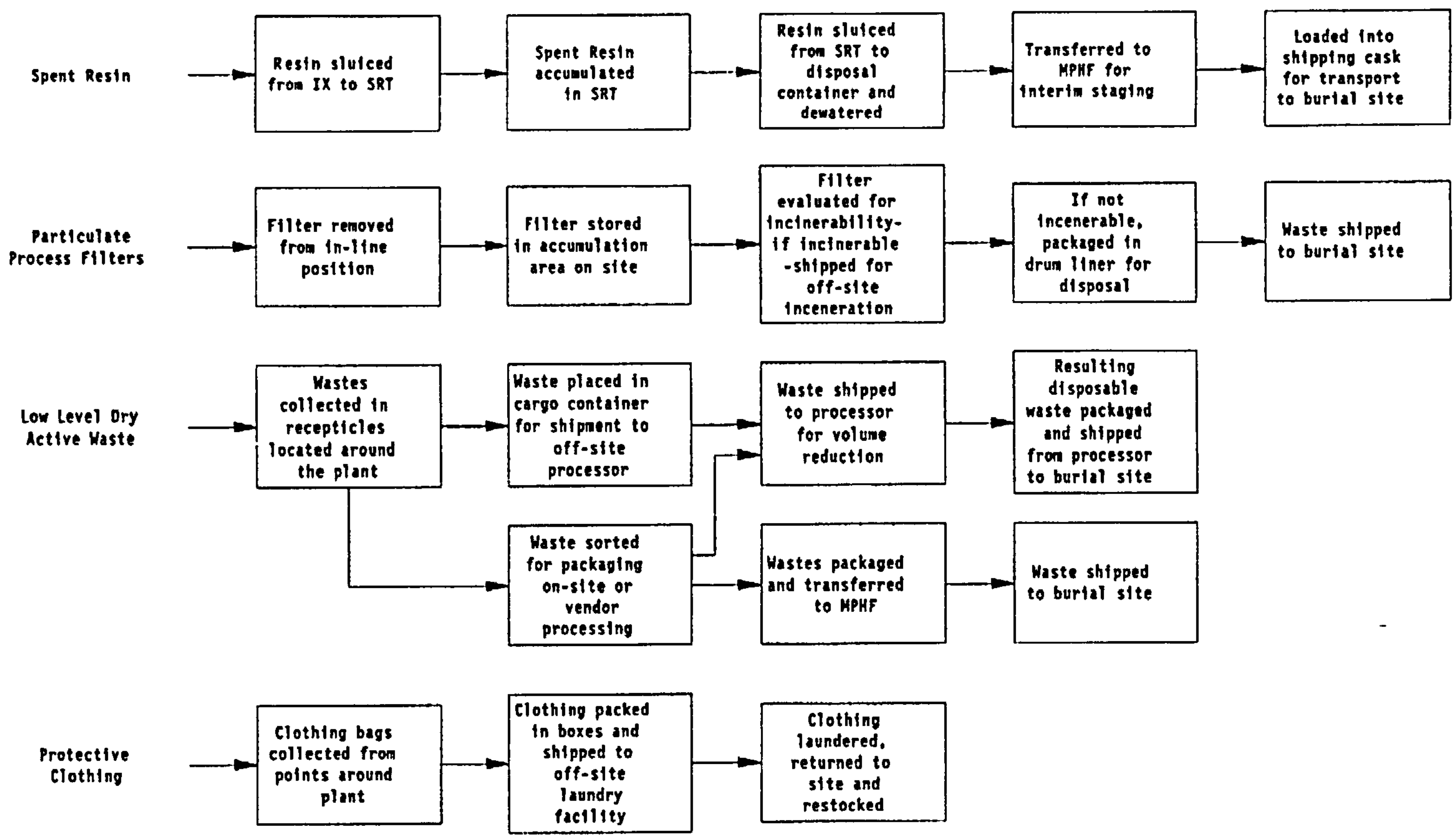


FIGURE 4-6 SONGS 2 & 3 RADIOACTIVE GASEOUS WASTE TREATMENT SYSTEMS



(1) 2(3)RT-7865-1 can be aligned to either containment purge or the plant vent stack

FIGURE 4-7 SOLID WASTE HANDLING



LEGEND:
SRT: Spent Resin Tank
MPHF: Multi Purpose Handling Facility
IX:Ion Exchanger

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

5.1 Monitoring Program

SPECIFICATION

5.1.1 The radiological environmental monitoring program shall be conducted as specified in Table 5-1. The requirements are applicable at all times.

APPLICABILITY: At all times

ACTION:

a. Should the radiological environmental monitoring program not be conducted as specified in Table 5-1, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report (see Section 5.4), a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. Should the level of radioactivity in an environmental sampling medium exceed the reporting levels of Table 5-2 when averaged over any calendar quarter, in lieu of any other report required by Technical Specification Section 5.7.1 and LCS 5.0.104, prepare and submit to the Commission, within 30 days from the end of the affected calendar quarter a Report pursuant to 10 CFR 50.73. When more than one of the radionuclides in Table 5-2 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{limit level (1)}} + \frac{\text{concentration (2)}}{\text{limit level (2)}} + \ldots \geq 1.0$$

c. When radionuclides other than those in Table 5-2 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to an individual is equal to or greater than the calendar year limits of Specification(s) 1.2.1, 2.2.1 or 2.3.1, as appropriate. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report (see Section 5.4).

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

ACTION: (Continued)

d. With fresh leafy vegetable samples or fleshy vegetable samples unavailable from one or more of the sample locations required by Table 5-1, identify specific locations for obtaining replacement samples and add them within 30 days to the Radiological Environmental Monitoring Program given in the ODCM. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Technical Specification 5.7.1, submit in the next Annual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table for the ODCM reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of the new location(s) for obtaining samples.

SURVEILLANCE REQUIREMENTS

.1 The radiological environmental monitoring samples shall be collected pursuant to Table 5-1 from the locations given in Table 5-4 and Figures 5-1 through 5-5 and shall be analyzed pursuant to the requirements of Tables 5-1 and 5-3.

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations[a]	Sampling and Collection Frequency[a]	Type and Frequency of Analyses
1. AIRBORNE Radioiodine and Particulates	Samples from at least 5 locations 3 samples from offsite locations (in different sectors) of the highest calculated annual average ground level D/Q. 1 sample from the vicinity of a community having the the highest calculated annual average ground-level D/Q. 1 sample from a control location 15-30 km (10-20 miles) distant and in the least prevalent wind direction[c]	Continuous operation of sampler with sample collection as required by dust loading, but at least once per 7 days.[d]	Radioiodine cartridge. Analyze at least once per 7 days for I-131. Particulate sampler. Analyze for gross beta radioactivity $\geq$ 24 hours following filter change. Perform gamma isotopic[b] analysis on each sample when gross beta activity is > 10 times the yearly mean of control samples. Perform gamma isotopic analysis on composite (by location) sample at least once per 92 days.
2. DIRECT RADIATION[e]	At least 30 locations including an inner ring of stations in the general area of the site boundary and an outer ring approximately in the 4 to 5 mile range from the site with a station in each sector of each ring. The balance of the stations is in special interest areas such as population centers, nearby residences, schools, and in 2 or 3 areas to serve as control stations.	At least once per 92 days.	Gamma dose. At least once per 92 days.

TABLE 5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations[a]	Sampling and Collection Frequency[a]	Type and Frequency of Analyses
3. WATERBORNE			
a. Ocean	4 locations	At least once per month and composited[f] quarterly	Gamma isotopic analysis of each monthly sample. Tritium analysis of composite sample at least once per 92 days.
b. Drinking[g]	2 locations	Monthly at each location.	Gamma isotopic and tritium analyses of each sample.
c. Sediment	4 locations from Shoreline	At least once per 184 days.	Gamma isotopic analysis of each sample.
d. Ocean	5 locations Bottom Sediments	At least once per 184 days.	Gamma isotopic analysis of each sample.

TABLE 5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations[a]	Sampling and Collection Frequency[a]	Type and Frequency of Analyses
4. INGESTION			
a. Nonmigratory Marine Animals	3 locations	One sample in season, or at least once per 184 days if not seasonal. One sample of each of the following species: 1. Fish-2 adult species such as perch or sheephead. 2. Crustaceae-such as crab or lobster. 3. Mollusks-such as limpets, seahares or clams.	Gamma isotopic analysis on edible portions.
b. Local Crops	2 locations	Representative vegetables, normally 1 leafy and 1 fleshy collected at harvest time. At least 2 vegetables collected semiannually from each location.	Gamma isotopic analysis on edible portions semiannually and I-131 analysis for leafy crops.

TABLE NOTATION

a. Sample locations are indicated on Figures 5-1 through 5-5.

b. Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

c. The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites which provide valid background data may be substituted.

d. Canisters for the collection of radioiodine in air are subject to channeling. These devices should be carefully checked before operation in the field or several should be mounted in series to prevent loss of iodine.

e. Regulatory Guide 4.13 provides minimum acceptable performance criteria for thermoluminescence dosimetry (TLD) systems used for environmental monitoring. One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purpose of this table, a thermoluminescent dosimeter may be considered to be one phosphor and two or more phosphors in a packet may be considered as two or more dosimeters. Film badges should not be used for measuring direct radiation.

f. Composite samples should be collected with equipment (or equivalent) which is capable of collecting an aliquot at time intervals which are very short (e.g., hourly) relative to the compositing period (e.g., monthly).

g. No drinking water pathway exists at SONGS.

TABLE 5-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Marine Animals (pCi/Kg, wet)	Local Crops (pCi/Kg, wet)
H-3	2×10^4 (a)			
Mn-54	1×10^3		3×10^4	
Fe-59	4×10^2		1×10^4	
Co-58	1×10^3		3×10^4	
Co-60	3×10^2		1×10^4	
Zn-65	3×10^2		2×10^4	
Zr-95, Nb-95	4×10^2			
I-131	2 (b)	0.9		1×10^2
Cs-134	30	10	1×10^3	1×10^3
Cs-137	50	20	2×10^3	2×10^3
Ba-140, La-140	2×10^2			

(a) For drinking water samples. This is 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used.

(b) If no drinking water pathway exists, a value of 20 pCi/l may be used.

TABLE 5-3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[c]

MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD)[a]

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Marine Animals (pCi/Kg, wet)	Local Crops (pCi/Kg, wet)	Sediment (pCi/Kg, dry)
gross beta	4	1×10^{-2}			
H-3	2000[b]				
Mn-54	15		130		
Fe-59	30		260		
Co-58, 60	15		130		
Zn-65	30		260		
Zr-95, Nb-95	15				
I-131	1[d]	7×10^{-2}		60	
Cs-134	15	5×10^{-2}	130	60	150
Cs-137	18	6×10^{-2}	150	80	180
Ba-140, La-140	15				

TABLE 5-3 (Continued)

TABLE NOTATION

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

LLD is the "a priori" lower limit of detection as defined above (as microcurie per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per transformation),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection or end of the collection period and time of counting (for environmental samples, not plant effluents).

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples (e.g., potassium-40 in milk samples). Typical values of E,V,Y and Δt shall be used in the calculations.

It should be recognized that the LLD is defined as an _a priori_ (before the fact) limit representing the capability of the measurement system and not as _a posteriori_ (after the fact) limit for a particular measurement.*

*For a more complete discussion of the LLD, and other detection limits, see the following:

(1) HASL Procedures Manual, _HASL-300_ (revised annually).
(2) Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" _Anal. Chem. 40_, 586-93 (1968).

TABLE 5-3 (Continued)

TABLE NOTATION

b. If no drinking water pathway exists, a value of 3000 pCi/l may be used.

c. Other peaks which are measurable and identifiable, together with the radionuclides in Table 5-3, shall be identified and reported.

d. If no drinking water pathway exists, a value of 15 pCi/l may be used.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.2 LAND USE CENSUS

SPECIFICATION

5.2.1 A land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence and the nearest garden* of greater than 500 square feet producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of five miles.

APPLICABILITY: At all times

ACTION:

a. With the land use census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Specification 2.3.1, pursuant to Technical Specification 5.7.1, identify the new locations in the next Annual Radioactive Effluent Release Report.

b. With the land use census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained in accordance with Specification 5.1, add the new location within 30 days to the Radiological Environmental Monitoring Program given in the ODCM. The sampling location(s), excluding the control station location, having the lowest calculated dose or dose commitment(s) via the same exposure pathway, may be deleted from this monitoring program after October 31, of the year in which this Land Use Census was conducted. Pursuant to Technical Specification 5.7.1, submit in the next Annual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table(s) for the ODCM reflecting the new location(s) with information supporting the change in sampling locations.

SURVEILLANCE REQUIREMENTS

.1 The land use census shall be conducted at least once per 12 months between the dates of June 1 and October 1 using that information which will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities.

*Broad leaf vegetation sampling may be performed at the site boundary in the direction sector with the highest D/Q in lieu of the garden census.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.3 INTERLABORATORY COMPARISON PROGRAM

SPECIFICATION

5.3.1 Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program that complies with Regulatory Guide 4.15.

APPLICABILITY: At all times

ACTION:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

SURVEILLANCE REQUIREMENTS

.1 A summary of the results obtained as part of the above required Interlaboratory Comparison Program and in accordance with Section 5.4.1 of this document shall be included in the Annual Radiological Environmental Operating Report (see Section 5.4).

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.4 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT*

5.4.1 The annual radiological environmental operating reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of land use censuses required by Section 5.2. If harmful effects or evidence of irreversible damage are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

The annual radiological environmental operating reports shall include summarized and tabulated results in the Radiological Assessment Branch Technical Position, Revision 1, November 1979 of all radiological environmental samples taken during the report period. In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

The reports shall also include the following: a summary description of the radiological environmental monitoring program; a map of all sampling locations keyed to a table giving distances and directions from the mid-point of reactor Units 2 and 3; and the results of licensee participation in the Interlaboratory Comparison Program, required by Section 5.3.

* A single submittal may be made for a multiple unit station, combining those sections that are common to all units at the station.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.5 SAMPLE LOCATIONS

The Radiological Environmental Monitoring Sample Locations are identified in Figures 5-1 through 5-5. These sample locations are described in Table 5-4 and indicate the distance in miles and the direction, determined from degrees true north, from the center of the Units 2 and 3 building complex. Table 5-6 gives the sector and direction designation for the Radiological Environmental Monitoring Sample Location on Map, Figures 5-1 through 5-5.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation			
1	City of San Clemente (Former SDG&E Offices)	5.7	NW
2	Camp San Mateo (MCB, Camp Pendleton)	3.5	N
3	Camp San Onofre (MCB, Camp Pendleton)	2.6	NE
4	Camp Horno (MCB, Camp Pendleton)	4.5	E
6	Old Route 101 (East-Southeast)	3.0	ESE
8	Noncommissioned Officers' Beach Club	1.4	NW
10	Bluff (Adjacent to PIC #1)	0.7	WNW
11	Former Visitors' Center	0.4**	NW
12	South Edge of Switchyard	0.2**	E
13	Southeast Site boundary (Bluff)	0.4**	ESE
15	Southeast Site Boundary (Office Building)	0.1**	SSE
16	East Southeast Site Boundary	0.4**	ESE
17	Transit Dose	-	-
18	Transit Dose	-	-
19	San Clemente Highlands	5.0	NNW
22	Former U.S. Coast Guard Station - San Mateo Point	2.7	WNW
23	Samaritan Hospital, San Clemente	8.1	NW

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** MCB - Marine Corps Base PIC - Pressurized Ion Chamber

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation (Continued)			
31	Aurora Park-Mission Viejo	18.6	NNW
33	Camp Talega (MCB, Camp Pendleton)	5.7	N
34	San Onofre School (MCB, Camp Pendleton)	1.9	NW
35	Range 312 (MCB, Camp Pendleton)	4.7	NNE
36	Range 208C (MCB, Camp Pendleton)	4.2	NE
38	San Onofre State Beach Park	3.3	SE
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	NNW
41	Old Route 101 - East	0.3**	E
44	Fallbrook Fire Station	17.7	E
46	San Onofre State Beach Park	0.9	SE
47	Camp Las Flores (MCB, Camp Pendleton)	8.6	SE

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** MCB - Marine Corps Base PIC - Pressurized Ion Chamber

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation (Continued)			
49	Camp Chappo (MCB, Camp Pendleton)	12.8	ESE
50	Oceanside Fire Station (CONTROL)	15.6	SE
53	San Diego County Operations Center	44.3	SE
54	Escondido Fire Station	31.8	ESE
55	San Onofre State Beach (Unit 1, West)	0.2**	W
56	San Onofre State Beach (Unit 1, West)	0.2**	W
57	San Onofre State Beach (Unit 2)	0.1**	WSW
58	San Onofre State Beach (Unit 3)	0.1**	S
59	SONGS Meteorological Tower	0.3**	WNW
60	Transit Control Storage Area	-	-
61	Mesa - East Boundary (Adjacent to PIC #4)	0.7	N
62	MCB - Camp Pendleton (Adjacent to PIC #5)	0.6	NNE
63	MCB - Camp Pendleton (Adjacent to PIC #6)	0.6	NE
64	MCB - Camp Pendleton (Adjacent to PIC #7)	0.6	ENE
65	MCB - Camp Pendleton (Adjacent to PIC #8)	0.7	E
66	San Onofre State Beach (Adjacent to PIC #9)	0.6	ESE
67	Former SONGS Evaporation Pond (Adjacent to PIC #2)	0.6	NW
68	Range 210C (MCB, Camp Pendleton)	4.3	ENE
73	South Yard Facility	0.4**	ESE
	Transit Control A	-	-
	Transit control B	-	-
	Fader (Co-Located with TLD # 54)****	31.8	ESE
74	Oceanside City Hall (Backup CONTROL)	15.6	SE
75	Gate 25 MCB	4.6	SE
76	El Camino Real Mobil Station	4.6	NW
77	Area 62 Heavy lift pad	4.3	N
78	Sheep Valley	4.4	ESE

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** MCB - Marine Corps Base PIC - Pressurized Ion Chamber

**** For fading correction due to significant increase in temperature.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE* (miles)	DIRECTION*
Airborne			
1	City of San Clemente (City Hall)	5.1	NW
7	AWS Roof	0.18**	NW
9	State Beach Park	0.6	ESE
10	Bluff	0.7	WNW
11	Mesa EOF	0.7	NNW
12	Former SONGS Evaporation Pond	0.6	NW
13	Marine Corps Base (Camp Pendleton East)	0.7	E
14	Mesa Medical Facility	0.7	NNW
15	Oceanside City Hall (CONTROL)	15.6	SE
Soil Samples			
1	Camp San Onofre	2.6	NE
2	Old Route 101 - (East Southeast)	3.0	ESE
3	Basilone Road/I-5 Freeway Offramp	2.0	NW
5	Former Visitor's Center	0.4**	NW
6	Oceanside (CONTROL)	16.0	SE
Ocean Water			
A	Station Discharge Outfall - Unit 1	0.6	SW
B	Outfall - Unit 2	1.5	SW
C	Outfall - Unit 3	1.2	SSW
D	Newport Beach (CONTROL)	30.0	NW

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site boundary (0.4 mile in all sectors) and not required by Technical Specification.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE* (miles)	DIRECTION*	
Drinking Water				
4	Camp Pendleton Drinking Water Reservoir	2.2	NNW	
5	Oceanside City Hall (new CONTROL)	15.6	SE	
Shoreline Sediment (Beach Sand)				
1	San Onofre State Beach (Southeast)	0.6	SE	|R
2	San Onofre Surfing Beach	0.8	WNW	
3	San Onofre State Beach (Southeast)	3.5	SE	|R
4	Newport Beach (North End) (CONTROL)	29.2	NW	
Local Crops				
1	San Clemente Ranch (San Mateo Canyon)	2.6	NW	
2	Oceanside (CONTROL)**	15 to 25	SE to ESE	
4	San Clemente Resident w/Garden	4.4	NW	IF
6	SONGS Garden	0.4	NW	

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Control location should be in Section G or F, 15 to 25 miles from site. The control location will be selected based on sample availability. The exact location shall be noted in the Annual Radiological Environmental Operating Report.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE* (miles)	DIRECTION*	
Non-Migratory Marine Animals				
A	Unit 1 Outfall	0.9	WSW	
B	Units 2 and 3 Outfall	1.5	SSW	
C	Laguna Beach (CONTROL)	18.2	NW	
Kelp				
A	San Onofre Kelp Bed	1.5	S	
B	San Mateo Kelp Bed	3.8	WNW	
C	Barn Kelp Bed	6.3	SSE	
D	DELETED			|D
E	Salt Creek (CONTROL)	11 to 13	WNW to NW	|A
Ocean Bottom Sediments				
A	DELETED			|D
B	Unit 1 Outfall	0.8	SSW	|R
C	Unit 2 Outfall	1.6	SW	
D	Unit 3 Outfall	1.2	SSW	
E	Laguna Beach (CONTROL)	18.2	NW	
F	SONGS Upcoast	0.9	WSW	|A

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

TABLE 5-5

PIC - RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

PRESSURIZED ION CHAMBERS		Theta (Degrees)*	DISTANCE* Meters	miles	DIRECTION/SECTOR*	
S1	San Onofre Beach	298°	1070	0.7	WNW	P
S2	SONGS Former Evap. Pnd	313°	890	0.6	NW	Q
S3	Japanese Mesa	340°	1150	0.7	NNW	R
S4	MCB - Camp Pendleton	3°	1120	0.7	N	A
S5	MCB - Camp Pendleton	19°	1050	0.6	NNE	B
S6	MCB - Camp Pendleton	46°	940	0.6	NE	C
S7	MCB - Camp Pendleton	70°	870	0.6	ENE	D
S8	MCB - Camp Pendleton	98°	1120	0.7	E	E
S9	San Onofre State Beach	121°	940	0.6	ESE	F

* Distance (meters/miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Theta direction is determined from degrees true north.

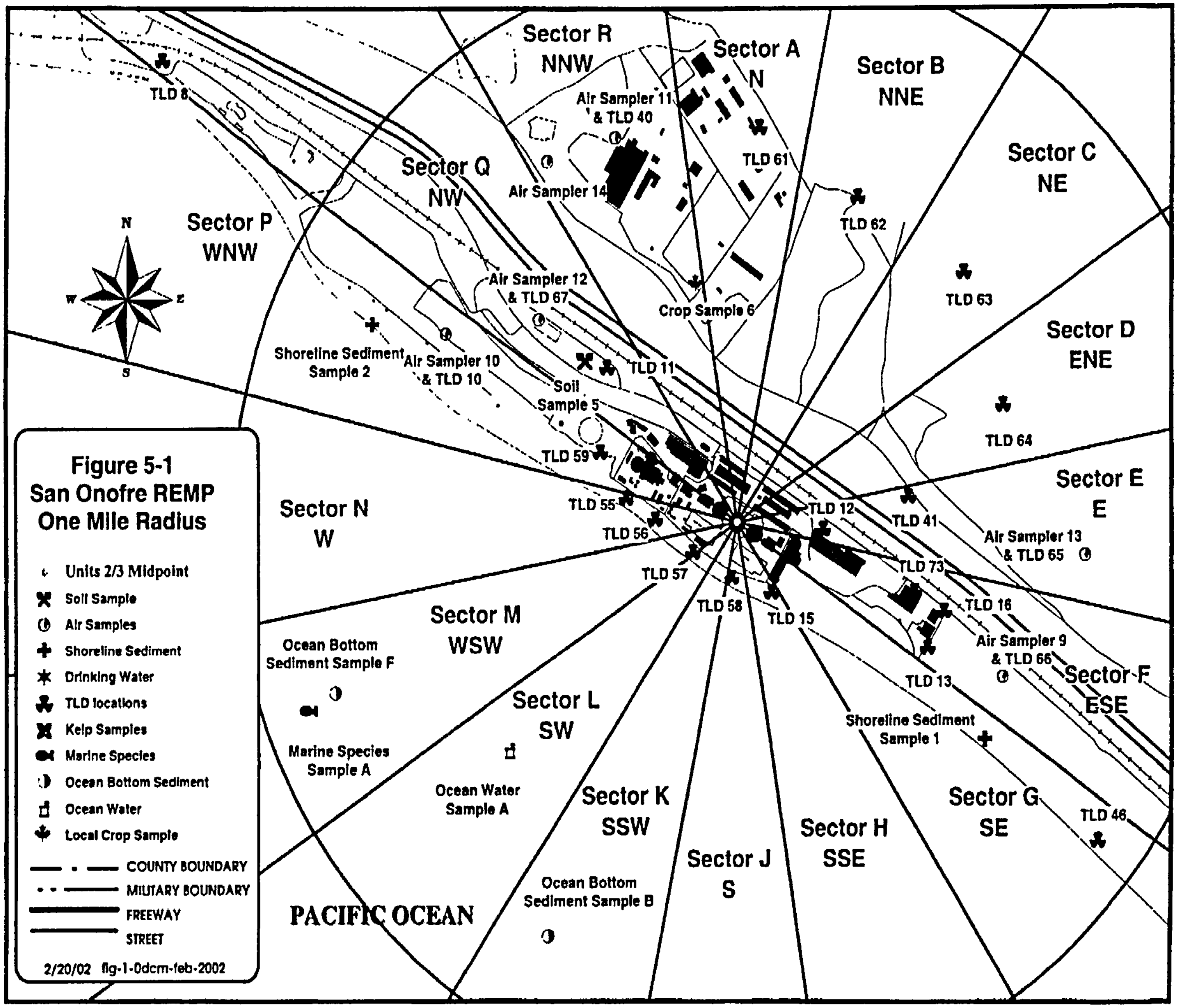
TABLE 5-6

SECTOR AND DIRECTION DESIGNATION FOR RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATION MAP

DEGREES TRUE NORTH FROM SONGS 2 AND 3 MID-POINT			NOMENCLATURE	
Sector Limit	Center Line	Sector Limit	22.5° Sector*	Direction
348.75	0 & 360	11.25	A	N
11.25	22.5	33.75	B	NNE
33.75	45.0	56.25	C	NE
56.25	67.5	78.75	D	ENE
78.75	90.0	101.25	E	E
101.25	112.0	123.75	F	ESE
123.75	135.0	146.25	G	SE
146.25	157.0	168.75	H	SSE
168.75	180.0	191.25	J	S
191.25	202.5	213.75	K	SSW
213.75	225.0	236.25	L	SW
236.25	247.5	258.75	M	WSW
258.75	270.0	281.25	N	W
281.25	292.5	303.75	P	WNW
303.75	315.0	326.25	Q	NW
326.25	337.5	348.75	R	NNW

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true North.

Figure 5-1
Radiological Environmental Monitoring Sample Locations
1 Mile Radius



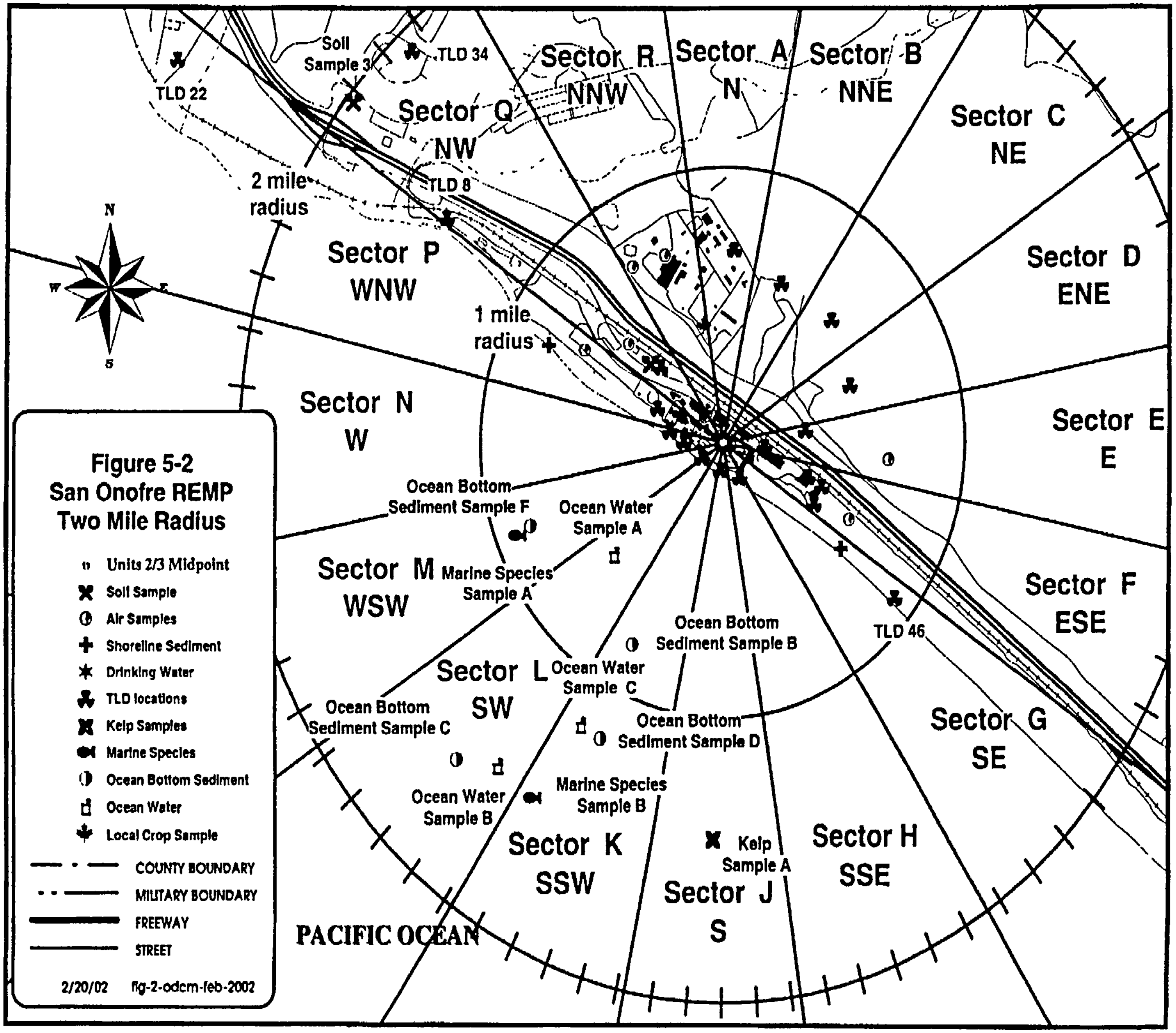
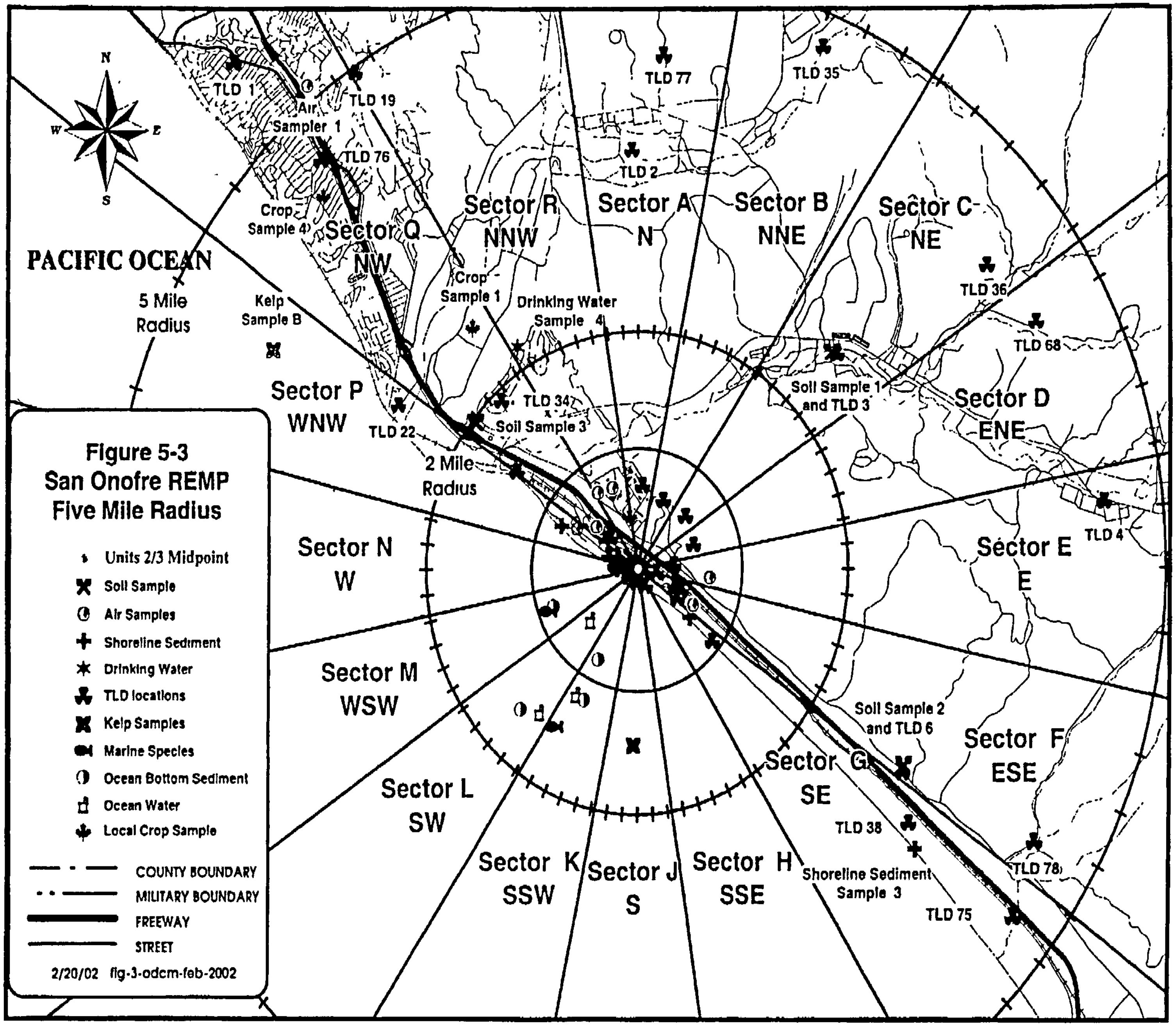


Figure 5-2
Radiological Environmental Monitoring Sample Locations
2 Mile Radius

Figure 5-3
Radiological Environmental Monitoring Sample Locations
5 Mile Radius



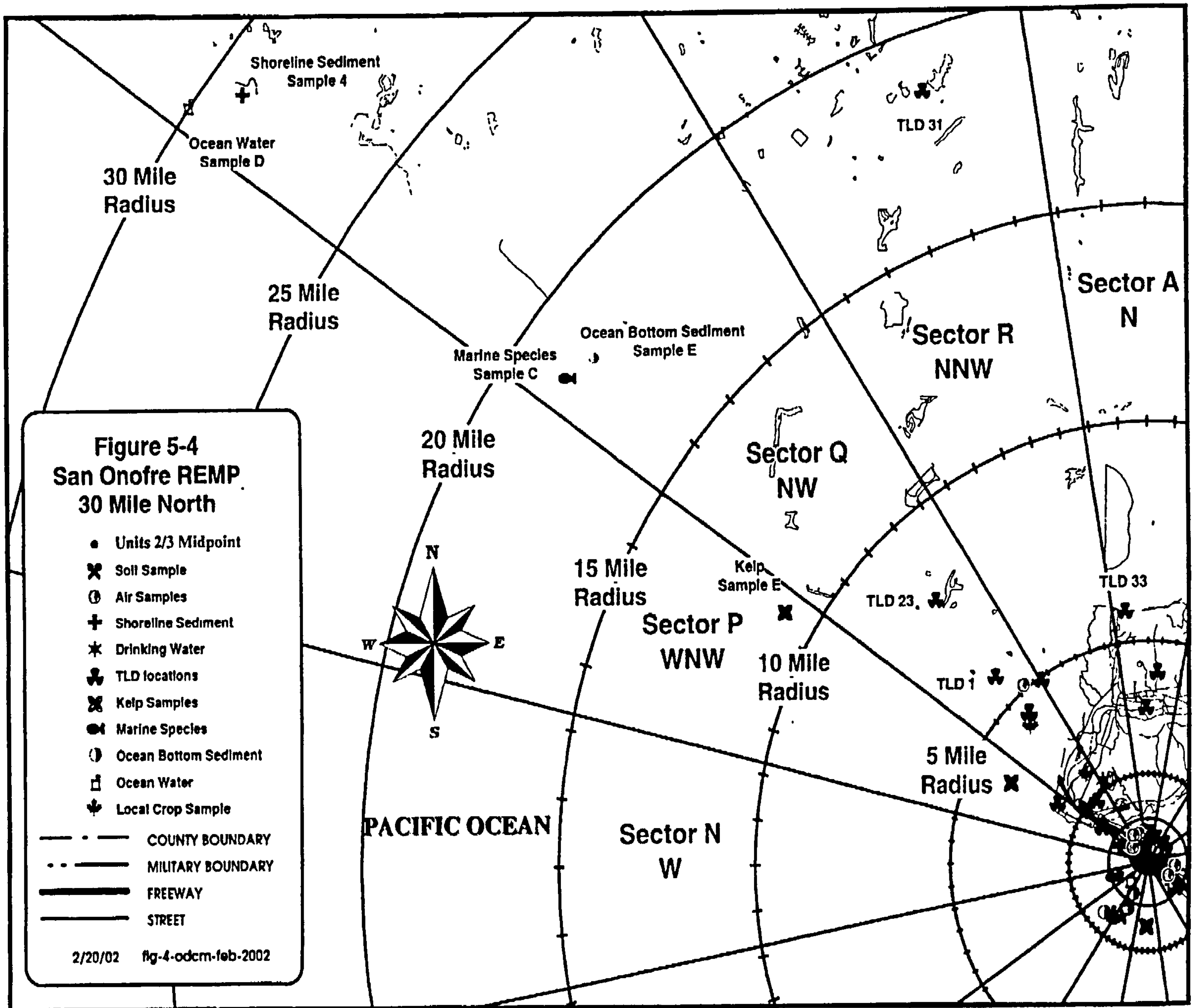


Figure 5-4
Radiological Environmental Monitoring Sample Locations - Orange County

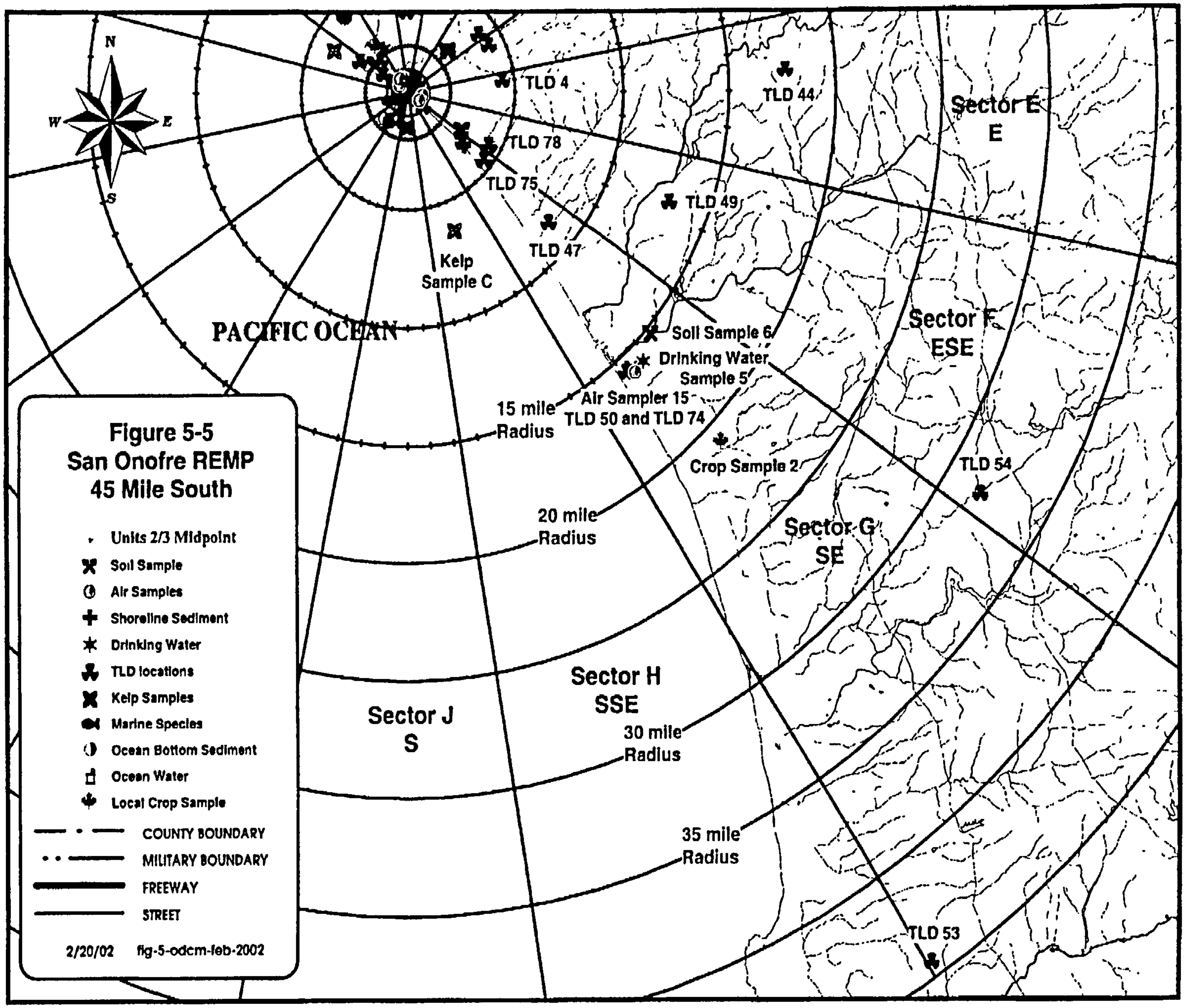


Figure 5-5
Radiological Environmental Monitoring Sample Locations - San Diego County

6.0 ADMINISTRATIVE

6.1 DEFINITIONS

The defined terms of this section appear in capitalized type and are applicable through these Specifications.

ACTION

6.1.1 ACTION shall be that part of a specification which prescribes remedial measures required under designated conditions.

CHANNEL CALIBRATION

6.1.2 A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds with the necessary range and accuracy to known values of the parameter which the channel monitors. The CHANNEL CALIBRATION shall encompass the entire channel, including the sensor and alarm and/or trip functions, and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated.

CHANNEL CHECK

6.1.3 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

CHANNEL FUNCTIONAL TEST

6.1.4 A CHANNEL FUNCTIONAL TEST shall be:

a. Analog channels - the injection of a simulated signal into channel as close to the sensor as practicable to verify OPERABILITY, including alarm and/or trip functions.

b. Bistable channels - the injection of a simulated signal into the sensor to verify OPERABILITY, including alarm and/or trip functions.

c. Digital computer channels - the exercising of the digital computer hardware using diagnostic programs and the injection of simulated process data into the channel to verify OPERABILITY.

6.0 ADMINISTRATIVE (Continued)

DOSE EQUIVALENT I-131

6.1.5 DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in International Commission on Radiological Protection Publication 30, Tables titled Committed Dose Equivalent in Target Organs or Tissues per Intake of Unit Activities.

FREQUENCY NOTATION

6.1.6 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 6.2.

GASEOUS RADWASTE TREATMENT SYSTEM

6.1.7 A GASEOUS RADWASTE TREATMENT SYSTEM is any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

6.1.8 **DELETED**

MEMBERS OF THE PUBLIC

6.1.9 MEMBER(S) OF THE PUBLIC shall include all individuals who by virtue of their occupational status have no formal association with the plant. This category shall include nonemployees of the licensee who are permitted to use portions of the site for recreational, occupational, or purposes not associated with plant functions. This category shall not include non-employees such as vending machine servicemen or postmen who, as part of their formal job function, occasionally enter an area that is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

6.0 ADMINISTRATIVE (Continued)

MODE

6.1.10 A MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 6-1 with fuel in the reactor vessel.

OPERABLE - OPERABILITY

6.1.11 A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication and other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).

PURGE - PURGING

6.1.12 PURGE or PURGING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

SITE BOUNDARY

6.1.13 The SITE BOUNDARY shall be that line beyond which the land is not owned, leased, or otherwise controlled by the licensee.

SOLIDIFICATION

6.1.14 SOLIDIFICATION shall be the conversion of radioactive wastes from liquid systems to a homogeneous (uniformly distributed), monolithic, immobilized solid with definite volume and shape, bounded by a stable surface of distinct outline on all sides (free-standing).

6.0 ADMINISTRATIVE (Continued)

SOURCE CHECK

6.1.15 For Victoreen and NMC analog monitors a SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source. [2(3)RT-6753, 2(3)RT-6759, 2(3)RT-7818A]

For Sorrento Electronics digital monitors a SOURCE CHECK shall be the verification of proper computer response to a check source request. [2(3)RT-7828, 2(3)RT-7865-1, 2(3)RT-7870-1]

For MGPI monitors a SOURCE CHECK shall be the verification of proper computer response to the continuous internal detector, monitor calibration and electrical checks. [2(3)RT-7817, 2(3)RT-7821, 2/3RT-7813, 2/3RT-7808, SYFRT-7904, SYFRT-7905]

SURVEILLANCE REQUIREMENT: MEETING SPECIFIED FREQUENCY

6.1.16 The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met.

For Frequencies specified as "once," the above interval extension does not apply.

If a Completion Time requires periodic performance on a "once per ..." basis, the above Frequency extension applies to each performance after the initial performance.

This provision is not intended to be used repeatedly as a convenient means to extend surveillance intervals beyond those specified. Additionally, it does not apply to any Action Statements.

THERMAL POWER

6.1.17 THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

VENTILATION EXHAUST TREATMENT SYSTEM

6.1.18 A VENTILATION EXHAUST TREATMENT SYSTEM is any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal absorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment (such a system is not considered to have any effect on noble gas effluents). Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

6.0 ADMINISTRATIVE (Continued)

VENTING

6.1.19 VENTING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent used in system names does not imply a VENTING process.

TABLE 6-1

OPERATIONAL MODES

OPERATION MODE	REACTIVITY CONDITION, (K_{eff})	% OF RATED THERMAL POWER(a)	AVERAGE COOLANT TEMPERATURE (°F)
1. POWER OPERATION	≥ 0.99	> 5%	NA
2. STARTUP	≥ 0.99	≤ 5%	NA
3. HOT STANDBY	< 0.99	NA	≥ 350°F
4. HOT SHUTDOWN	< 0.99	NA	350°F> T_{avg}>200°F
5. COLD SHUTDOWN (b)	< 0.99	NA	≤ 200°F
6. REFUELING (c)	NA	NA	NA

(a) Excluding decay heat.
(b) All reactor vessel head closure bolts fully tensioned.
(c) One or more reactor vessel head closure bolts less than fully tensioned.

TABLE 6-2

FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours
D	At least once per 24 hours
W	At least once per 7 days
M	At least once per 31 days
Q	At least once per 92 days
SA	At least once per 184 days
R	At least once per 18 months*
S/U	Prior to each reactor startup
P	Completed prior to each release
N.A.	Not applicable
Refueling Interval	Not to exceed 24 months

*A month is defined as a 31-day period.

6.0 ADMINISTRATIVE (Continued)

6.2 ADMINISTRATIVE CONTROLS

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT*

6.2.1 Routine radioactive effluent release reports covering the operation of the unit during the previous calendar year shall be submitted before May 1 of each year.

6.2.2 The radioactive effluent release reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, "Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The radioactive effluent release report shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, and atmospheric stability, and precipitation (if measured) on magnetic tape, or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (Figure 1-2 and 2-2) during the report period. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the OFFSITE DOSE CALCULATION MANUAL (ODCM).

* A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the Station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

6.0 ADMINISTRATIVE (Continued)

6.2 ADMINISTRATIVE CONTROLS (Continued)

6.2.2 (Continued)

The radioactive effluent release report shall also include an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous 12 consecutive months to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1.

The radioactive effluents release shall include the following information for each type of solid waste shipped offsite during the report period:

a. Container volume,

b. Total curie quantity (specify whether determined by measurement or estimate),

c. Principal radionuclides (specify whether determined by measurement or estimate),

d. Type of waste (e.g., spent resin, compacted dry waste, evaporator bottoms),

e. Type of container (e.g., LSA, Type A, Type B, Large Quantity), and

f. Solidification Agent (e.g., cement, urea formaldehyde).

The radioactive effluent release report shall include unplanned releases from the site to unrestricted areas of radioactive materials in gaseous and liquid effluents. Made during the reporting period. |R

The radioactive effluent release reports shall include any changes to the PROCESS CONTROL PROGRAM (PCP) made during the reporting period.

6.0 ADMINISTRATIVE (Continued)

6.3 MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS (Liquid, & Gaseous)

Licensee initiated major changes to the radioactive waste systems (liquid & gaseous):

1. Shall be reported to the Commission in the Annual Radioactive Effluent Release Report for the period in which the evaluation was performed pursuant to Quality Assurance Program Description (SCE-1-A), Subsection 17.2.20.3.1.i. The discussion of each change shall contain:

   a. A summary of the evaluation that led to the determination that the change could be made in accordance with applicable regulations;

   b. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

   c. A detailed description of the equipment, components and processes involved and the interfaces with other plant systems;

   d. An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents that differ from those previously predicted in the license application and amendments thereto;

   e. An evaluation of the change which shows the expected maximum exposures to individual in the unrestricted area and to the general population that differ from those previously estimated in the license application and amendments thereto;

   f. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents to the actual release for the period prior to when the changes are to be made;

   g. An estimate of the exposure to plant operating personnel as a result of the change; and

   h. Documentation of the fact that the change was reviewed and found acceptable pursuant to Quality Assurance Program Description (SCE-1-A), Subsection 17.2.20.3.1.i.

2. Shall become effective upon review and acceptance pursuant to Quality Assurance Program Description (SCE-1-A), Subsection 17.2.20.3.1.i.

6.0 ADMINISTRATIVE (Continued)

6.4 BASES

LIQUID EFFLUENTS

CONCENTRATION (1.1)

6.4.1 This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR 50, to an individual, and (2) the limits of 10 CFR 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

DOSE (1.2)

6.4.2 This specification is provided to implement the requirements of Section II.A, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable." The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

This specification applies to the release of liquid effluents from each reactor at the site. For units with shared radwaste treatment systems, the liquid effluents from the shared system are proportioned among the units sharing that system.

6.0 ADMINISTRATIVE (Continued)

6.4 BASES (Continued)

LIQUID WASTE TREATMENT (1.3)

6.4.3 The OPERABILITY of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

GASEOUS EFFLUENTS

DOSE RATE (2.1)

6.4.4 This specification is provided to ensure that the dose at any time at the site boundary from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area, either within or outside the site boundary, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)). For individuals who may at times be within the site boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

This specification applies to the release of gaseous effluents from all reactors at the site. For units with shared radwaste treatment systems, the gaseous effluents from the shared system are proportioned among the units sharing that system.

DOSE - NOBLE GASES (2.2)

6.4.5 This specification is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. For individuals who may at times be within the site boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. For MEMBERS OF THE PUBLIC who traverse the SITE BOUNDARY via highway I-5, the residency time shall be considered negligible and hence the dose "0". The ODCM equations provided for determining the air doses at the SITE BOUNDARY are based upon the historical average atmospheric conditions.

DOSE - RADIOIODINES, RADIOACTIVE MATERIALS IN PARTICULATE FORM AND TRITIUM (2.3)

6.4.6 This specification is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Conditions for Operation are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the Surveillance Requirements implement the

requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate specifications for radioiodines, radioactive materials in particulate form and tritium are dependent on the existing radionuclide pathways to man, in the unrestricted area. The pathways which were examined in the development of these calculations were: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

GASEOUS RADWASTE TREATMENT (2.4)

6.4.7 The OPERABILITY of the GASEOUS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

6.0 ADMINISTRATIVE (Continued)

6.4 BASES (Continued)

TOTAL DOSE (3.3)

6.4.8 This specification is provided to meet the dose limitations of 40 CFR 190. The specification requires the preparation and submittal of a Special Report whenever the calculated doses from plant radioactive effluents exceed twice the design objective doses of Appendix I. For sites containing up to 4 reactors, it is highly unlikely that the resultant dose to a member of the public will exceed the dose limits of 40 CFR 190 if the individual reactors remain within the reporting requirement level. The Special Report will describe a course of action which should result in the limitation of dose to a member of the public for 12 consecutive months to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the member of the public from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered. If the dose to any member of the public is estimated to exceed the requirements of 40 CFR 190, the Special Report with a request for a variance in accordance with the provisions of 40 CFR 190.11, is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed provided the release conditions resulting in violation of 40 CFR 190 have not already been corrected. An individual is not considered a member of the public during any period in which he/she is engaged in carrying out any operation which is part of the nuclear fuel cycle.

RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION (4.1)

6.4.9 The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

6.0 ADMINISTRATIVE (Continued)

6.4 BASES (Continued)

RADIOACTIVE GASEOUS EFFLUENT INSTRUMENTATION (4.2)

6.4.10 The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. This instrumentation also includes provisions for monitoring and controlling the concentrations of potentially explosive gas mixtures in the waste gas holdup system. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

MONITORING PROGRAM (5.1)

6.4.11 The radiological monitoring program required by this specification provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides, which lead to the highest potential radiation exposures of individuals resulting from the station operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. The initially specified monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The detection capabilities required by Table 5-1 are state-of-the-art for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an *a priori* (before the fact) limit representing the capability of a measurement system and not as *a posteriori* (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

6.4 BASES (Continued)

LAND USE CENSUS (5.2)

6.4.12 This specification is provided to ensure that changes in the use of UNRESTRICTED AREAS are identified and that modifications to the monitoring program are made if required by the results of this census. The best survey information from the door-to-door, aerial or consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 500 square feet provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were used, 1) that 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and 2) a vegetation yield of 2 kg/square meter.

INTERLABORATORY COMPARISON PROGRAM (5.3)

6.4.13 The requirement for participation in an Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.